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JANUARY

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Louis E. Van Norman

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SHIFTING CULTIVATION
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STRUCTURE OF ELBE RIVER TRAFFIC
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MINERAL RESOURCES OF THE WORLD
H. W. Straley, III

GREENLAND: A PRODUCTIVE ARCTIC COLONY
Herman R. Friis

THREE MAJOR PHYSICAL DIVISIONS OF THE UPPER TENNESSEE BASIN
G. Donald Hudson

CLARK UNIVERSITY, WORCESTER, MASSACHUSETTS, U.S.A.

OUR CONTRIBUTORS

Mr. Van Norman now represents the Department of Commerce on the Committee for Reciprocity Information; for many years he served the Department as Trade Commissioner and Commercial Attaché at a number of European capitals. As member of the editorial staffs of the *Chatauquan*, the *Review of Reviews*, *Literary Digest*, and *Nation's Business*, and as free lance, he has written numerous books and magazine articles, dealing with international aspects of general business and economics.

Miss Baugh, assistant professor in the department of geography in the University of California at Los Angeles, has long centered her research upon problems of water supply, both urban and rural, in California, and has written much upon them.

Dr. Whittlesey has only recently returned from a long season's survey of agricultural and other developments in Latin America and low-latitude Africa, where the pattern of man's occupancy of the tropics and his utilization of their resources may be best studied. His material bears the stamp of thorough research and scholarly interpretation.

Miss Kusch, until recently active in the teaching of geography in Cleveland public schools, is now engaged in advanced graduate study at the University of Chicago by which she was awarded her Master of Science degree.

Mr. Straley combines many years of teaching experience in Concord and Bluefield colleges and the University of North Carolina with much experience as field engineer, geologist and geophysicist in oil, coal, and metal exploration. He is by profession a mining engineer.

Mr. Friis, graduate student at the University of Wisconsin the past two and a half years and previously at the University of California at Los Angeles where he achieved his B.A. and at Berkeley where he was awarded his A.M., has been particularly interested in the historical distribution of population in the United States from 1624 to 1930, for which he has completed an excellent series of maps. He is nephew to Dr. Morten P. Porsild, director of the Danish Arctic Station at Godhavn.

Dr. Hudson, chief of the Land Classification Section of the Tennessee Valley Authority in the Division of Land Planning and Housing, includes on his staff eleven geographers representing four institutions and a number of statisticians and draftsmen. His articles have already appeared in *Economic Geography;* more are to follow.

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CALIFORNIA

THE metal gold of stream gravels and canyon ledges; the liquid gold of brilliant sunshine over snow-clad mountains and wind-rippled sea; the tender gold of peach and apricot and orange ripening on the tree; the plans and dreams of a golden future for every citizen—these are California, the golden state of our American Union! There is health in California, there is joy in California, there is rest for the weary and peace to the distressed.

Yet withal, California is no fancy, no fantasy. California is a state wherein man may live well and happily, only if he is willing to plan, to work, to give his best toward the common weal. Broad vision, strength of mind and purpose and heart, thought for the future, regard for Nature; the Californian must have all these if he would achieve the destiny of his state.

His staunchest structure the earthquake would raze; his most fertile fields the drought would destroy; his choicest orchards the frosts would sear. The raging torrent from the snowfed hills would wreck his roads, and grim fires would blacken his forests. He must face them unafraid.

With all its golden opportunities California is the dark crucible where the fine metal of man's character is wrought out by test and struggle. Its varied landscape, its multiplicity of form and influence, its diversity of weather and ways, make California a laboratory of social and economic and political experiment for man's living, and living with his fellows, more wisely, more generously, more thoughtfully for the future; where man may integrate himself and find his happiest place in the body civic.

ECONOMIC GEOGRAPHY

VOL. 13 JANUARY, 1937 NO. 1

INTERNATIONAL TRADE IS CONVALESCING

Louis E. Van Norman

THE statesmen—or politicians—who lead their people into a war seldom see farther than the movements of battalions in the field. Never do they visualize situations beyond the immediate "fruits of victory."

In 1914 no one in Europe, apparently, had the slightest idea of the economic consequences of the war into which they were entering with such hopes of national aggrandizement; no one, that is to say, among the military leaders. Yes, there was one. The remark is attributed to Marshall Joffre. When asked who would win the war, he replied, "No matter who wins, everybody loses."

THE GRIM HERITAGE OF WAR

The World War left the nations of Europe bankrupt, and we in the United States did not long escape the consequences of the destruction of life and property. The lands of Europe were wasted; their capital eaten up; their resources dissipated. Many of their gold currencies vanished. Beneath and more serious than all this, their man-power was reduced and their ability to recoup curtailed. In all of them the struggle left a heritage of debt, economic jealousy, and natural hatred. These all bore fruit in what has been aptly described as a "blind and snarling nationalism."

After the so-called "peace" treaties were signed, we, in the United States, became rich with gold, and fat with war profits. We had enormously expanded our economic equipment. This blinded us and we came fondly to believe that we could continue to supply goods to the world at high prices, forgetful of the fact that our actual and potential customers had no money with which to pay. We demanded the settlement of war loans and declined to accept goods or services in payment. At the same time we loaned money to the war-stricken nations to enable them to continue to buy—at swollen prices—the products of our greatly expanded industrial and agricultural equipment. This situation developed a fever which, in the older world, took the form of national insolvency and currency inflation. The net result was the great depression. But that was not confined to Europe.

"NATIONALISM" RUN WILD

In a desperate effort to cure this trade malady, most of the governments of the old world turned to various fantastic artificial devices to establish a favorable trade balance and protect their industry or to secure commercial advantages for themselves in dealing with other nations. At the same time they adopted a stern regimentation of their domestic economy.

Immediately after the war and again after the depression became world wide, the restriction, in some cases almost the hamstringing, of imports became a veritable mania. Business men and labor alike in every land pleaded, generally successfully, with their respective

governments for more and even more "protection" against the products of other lands. Even well-informed people, with no personal interest at stake, lightly accepted the theory that every dollar, or pound, or franc, of import trade is a dollar lost to the importing country. More than once since the close of the war, the United States revised its tariff structure upward. Other countries increased trade barriers in order—as they believed—to reserve the home market for domestic producers, and, in so doing, invited retaliation. Frequently they destroyed the foreign markets which had been an important outlet for the excess production of their industries.

Result in World Trade Chaos

This trend toward "economic nationalism" and "self-containment" in all parts of the world was swiftly leading to international, economic, and social crises. The gradual but steady lowering of the standards of living in the old-world nations, so dependent upon other lands for many essential products, and the shifting of human and natural resources brought on a condition fraught with dire consequences and much international loss and friction.

England, for the first time in her history, adopted a protective tariff, while the nations on the continent piled import and export restrictions upon one another until the situation became more than burdensome. It was ridiculous. A complicated system of quotas, exchange controls, and clearing agreements was set up. These increased with the years, until even the most obdurate of European statesmen began to realize that no one could benefit by basing his trade relations on the principle of spiting the other fellow. The view that one nation should not buy from another anything even indirectly or remotely competitive is a dangerous game for all who play it. The operation of every conceivable fantastic method of obstructing and choking trade, such as quotas, tariffs, exchange restrictions, clearing arrangements, embargoes, and numerous others, has shown this conclusively. Add to these trade barriers the problem of fluctuating currencies and you have a situation which made international trade the most risky and uncertain of any type of business activity.

Are We to Have Currency Stabilization at Last?

In the summer of 1933 the World Economic Conference assembled in London. At that meeting an attempt was made to agree upon a workable scheme for the stabilization of currencies as a basis for world recovery. No agreement seemed possible at the time, although statesmen openly admitted the necessity for some understanding. It was not until September, 1936, that France, Italy, Holland, Belgium, and certain other countries of Europe less actively interested in foreign trade, realized the identity of their interests with those of Great Britain and the United States. The devaluation of the French franc and the Italian lira, and certain other currencies together with the loosing of various price controls and the easing of the quota situation in more than one country made the prospects look considerably brighter. At the same time the Economic Commission of the League of Nations, at Geneva, adopted a resolution urging the commercial and industrial nations of the world to abolish or reduce the many restrictions now hampering international commerce. The agreement between the governments of Britain, France, and the United States as to currencies has also helped somewhat.

Secretary of State Hull believes that

the currency stabilization moves should be part of the general program for a restoration of international trade. The freeing of currency, he has stated, is a coördinate part of the task of removing obstructions to world commerce. The other part is combating the system of quotas and high tariffs.

THE URGE TO "DO SOMETHING AT ONCE"

One obstacle to the removal of trade restrictions at the London Economic Conference was the further commitment of Great Britain to her policy of so-called Imperial Preference which amounted to setting the Empire against the rest of the world. On the continent of Europe "nationalism" held full sway.

DANGER OF A WORLD TRADE COLLAPSE

By 1933, the situation in world trade had become about as bad as it could be. As a result of the cumulative influence of the policies of nationalism such trade had practically collapsed. Every new restriction imposed by the trading nations—in a blind effort to benefit their own economies—added to the confusion.

Measured by value, world trade in 1933 had fallen to not more than one-third of its former level and to some three-quarters of its former volume. Our own share had fared even worse. In terms of gold value it had shrunk to scarcely more than one-quarter of its 1929 proportions and to some 60 per cent of its volume in that peak year. Our share of the rapidly declining world trade had fallen from about 14 to less than 10 per cent.

In the period from 1929 to 1933, the value of the exports of all the producing nations of the world had declined from 33 billion dollars to less than 12 billion dollars, a loss of almost two-thirds. To many large enterprises this meant heavy reductions in profits, the laying off of a good deal of unnecessary labor and a general decrease of operations until better times might come. To the small firms engaged in foreign trade, too often it meant disaster and the bankruptcy courts.

WORLD TRADE NOW SLOWLY BETTERING

In spite of the reluctance of the trading nations to realize or, at least, to admit their interdependence, commerce among nations, thanks to the resiliency of natural economic forces, has now begun to come back, very slowly, it is true, but none the less surely. This natural recovery is being accelerated by the trade agreements program.

A study of world trade during the year 1935 (by the Economic Intelligence Service of the League of Nations) indicates that in that year, for the first time since 1929, the value of all commerce between nations (that is to say imports plus exports) increased. The increase

TABLE I

PERCENTAGE CHANGE AS COMPARED WITH PRECEDING YEAR

	Prices (in Gold)		*Quantum*		*Value (in Gold)*	
Year	*Imports*	*Exports*	*Imports*	*Exports*	*Imports*	*Exports*
1927	− 2.5	− 2.5	+ 7.8	+ 8.1	+ 5.1	+ 5.4
1928	− 1	0	+ 3.6	+ 3.6	+ 2.6	+ 3.8
1929	− 3	− 3.5	+ 5.5	+ 4.5	+ 2.8	+ 1
1930	−13	−13	− 6.1	− 7.8	−18.3	−19.8
1931	−21.5	−23	− 8.8	− 7.4	−28.4	−28.7
1932	−22.5	−22.5	−13.4	−12	−32.9	−31.8
1933	−11.5	−10.5	+ 1.1	+ 2	−10.9	− 9
1934	− 7.5	− 7.5	+ 3.9	+ 4.2	− 3.9	− 3.5
1935	− 2.5	− 2.5	+ 4.4	+ 4.6	+ 1.8	+ 2

(The discrepancies between the "quantum" figures calculated for imports and exports are largely due to the imperfection of the statistical data employed, as well as to fluctuating exchanges.)

was 1.9 per cent in terms of gold, although, it is pointed out, average gold prices were somewhat lower in 1935 than in 1934. The quantity was about 4.5 per cent greater than in 1934, but still below the 1929 level of trade by approximately 18 per cent. According to this authority the percentages by which the price, quantity, and gold value of goods entering into world trade have changed, year by year, since 1927 are as shown in Table I.

Manufactured articles, it would appear, declined in gold price between 1934 and 1935 more than other commodities. Prices of foodstuffs fell slightly, while those of raw materials, on the average, remained unchanged. Generally speaking, therefore, the position of countries producing agricultural and mineral staples was improved as to quantity, although it was the collapse of raw material and foodstuffs prices that had ushered in the depression. Foodstuffs, raw materials, and manufactured articles all shared in a moderate increase. The increase in the trade in foodstuffs was the least, leaving the total still below the level of 1932 which was the lowest point in world trade. Raw materials and manufactured articles were shipped in greater quantities, mainly on account of iron and steel, such as building materials, heavy metal manufactures, machinery, and vehicles and other capital goods for industrial use. The trade of Europe decreased by 2 per cent in gold value in 1935. That of all other continents combined rose by more than 6 per cent, the largest contribution being made by North America.

How Exports Fared—and Imports

As to exports, the United States, the United Kingdom, Germany, and Japan were among the principal countries which increased their share. The exports of France fell off heavily. "The increase by roughly one-fourth in the value and quantity of imports into the United States was of decisive importance for the countries exporting primary products, though it was to some extent offset by a fall in demand on the part of a number of European countries which, for currency reasons, imposed further restrictions on their imports."

Generally speaking, says the League report, international trade benefited from a moderate degree of currency stability in 1935. Exchange restrictions, however, particularly in Europe, continued to obstruct the exchange of goods.

Importance of Foreign Trade

Reckoned in terms of money it is a comparatively small percentage of the value of movable goods produced in the United States which is exported. Yet, in spite of this, foreign trade has always been an important factor in our national economy.

Before the close of the nineteenth century, the figures show the value of American goods shipped abroad had reached a total of more than $1,000,000,000 annually. During the first two decades of the present century our total foreign trade (both exports and imports) had increased to $6,500,000,000. Then the totals declined, although fluctuating from time to time until, in 1932, the low point of $1,600,000,000 was reached. Since the beginning of the century the total value of our exports has exceeded the total value of our imports. This was normal for a debtor country. When we became a creditor nation, an excess of imports was to be expected, as we could not otherwise collect our debts. For various reasons the import excess has been deferred. For the first eight months of the calendar year 1936, however, imports exceeded exports by $40,607,000.

Even though the total of exports is only 10 per cent of our movable goods, the foreign trade of the United States could not be wiped out without a large increase in unemployment and other serious consequences to our economic life. Just so long as we have natural resources and raw staples in quantities larger than our needs call for while other countries lack these products, and just so long as the United States can produce certain types of manufactured goods more economically than any other country, export trade will be profitable to us and beneficial to the countries to which we ship.

JUST HOW IMPORTANT ARE OUR IMPORTS?

An intensive study of our import statistics, by character, as well as volume, reveals some interesting facts and relations.

TABLE II

UNITED STATES MERCHANDISE TRADE ACCORDING TO DEPARTMENT OF COMMERCE FIGURES
(In millions of dollars)

Year	*Total Exports*	*General Imports*	*Balance of Exports*
1928	5,128	4,091	1,037
1929	5,241	4,400	841
1930	3,843	3,061	782
1931	2,424	2,090	334
1932	1,612	1,323	289
1933	1,675	1,450	225
1934	2,133	1,655	478
1935	2,283	2,047	236
Jan.–Sept. 1935	1,568	1,502	66
Jan.–Sept. 1936	1,732	1,765	−33

Total exports represent exports of domestic merchandise (articles "the growth, produce or manufacture of the United States) plus exports of foreign merchandise (imported merchandise shipped from the United States in the same condition as when it previously entered)."

General imports represent actual arrivals during the given period and include importations entered for immediate consumption (entries admitted free of duty and those upon which the duty was paid on arrival and which entered merchandising channels) plus entries for bonded customs warehouses (to be withdrawn at a subsequent date).

The import trade of the United States is chiefly in products which do not exist in this country or which cannot be produced economically within our borders. Coffee, silk, tin, and rubber, are just a few of these. A recent study by the Department of Commerce shows that these four alone made up just short of 22 per cent of the imports into the United States in 1923 and 25.6 per cent of our total imports during the period from 1926–30. Not only do imports keep us supplied with those products which we cannot produce at home, but they are necessary if we are to maintain our export markets.

EMPLOYMENT VALUE OF FOREIGN TRADE

It is difficult to estimate, on the basis of value, the number of people gaining a livelihood from export trade, but, in view of the greater amount of handling and transportation of merchandise involved in export trade as compared with domestic business, it is safe to say that, in 1929, international foreign trade furnished the means of livelihood for a world population nearly as great as that of the United States.

The decline in international trade by two-thirds of its value from 1929 to 1933 meant the loss of income for some 40,000,000 wage earners and their families. The problem of any nation, of the United States in particular, in the field of international trade, says the Commerce Department's study, is to "maintain or develop the exportation of products in which foreign nations are deficient, or which foreign nations have not learned to manufacture economically, and, at the same time, to import those products which do not exist locally or which can be produced locally only at an exorbitant cost or of inferior quality."

As an exporting nation our position is assured by our ability to supply the world with a wide range of agricultural, mineral, and manufactured products, frequently lacking in other countries or produced in these in sufficient quantity to meet the demands of domestic consumption.

NATURE HAS BEEN VERY GOOD TO THE UNITED STATES

From statistics compiled by this same Department, it is evident that the export trade of this republic is "in no way due to outstanding salesmanship or to a special genius for manufacture, but rather to natural advantages possessed by the United States." These advantages are three in number:

1. Abundant agricultural land, which permits of the production of food and industrial products at a relatively low cost.

2. The possession of minerals and natural crude materials (such as copper, petroleum, sulphur, turpentine, and others) which are lacking in many countries.

3. A vast home market which makes possible the economical production of certain products—particularly complicated machinery—at low cost on a mass production basis or, at least, on a fairly steady schedule of output. New inventions, naturally, new chemical processes, and the launching of novelties on the market are also important factors in export trade, but these are frequently only temporary and are not peculiar to the United States.

WHAT CAN BE DONE WITH UNSALEABLE SURPLUSES?

Because of the high productive capacity of the United States, upon which our standard of living in large part depends, international trade is an essential factor in our national economy.

At the heart of the difficulties we are facing today is the problem of unsaleable surpluses. As the world's greatest producer and consumer, our paramount interest as a nation lies in a removal of trade barriers, rather than in their perpetuation. A policy of economic isolation seeks not only to perpetuate those now in existence, but to establish further restrictions.

OUR SHARE IN WORLD PRODUCTION AND EXPORT

The United States, according to Department of Commerce statistics, supplies the following proportions of the world's production: three-fourths of the automobiles; three-fifths of the corn and petroleum; one-third of the coal and railways; two-fifths of the cotton and pig iron; one-fourth of the copper; and nearly one-fifth of the wheat. We depend on foreign markets to dispose of our large surpluses.

In the latest years for which figures are available, the United States exported approximately: two-thirds of its refined copper and patent side upper leather; one-half of its annual cotton crop and gum rosin; one-third of its agricultural machinery, sewing machines, lubricating greases, lubricating oils, and tobacco; one-fourth of its office appliances and power-driven metal-working machinery; two-fifths of its aircraft, dried fruits, printing and book-binding machinery, and borax; one-fifth of its tractors; and one-sixth of its radio apparatus.

What would it mean to American jobs if the foreign markets for these and other goods produced in this country should be closed entirely? The Department of State recently had the following to say in reply to this question:

"In the field of agriculture . . . we would have to retire over 40,000,000 acres of average farm land and let it go back to weeds or pasture land. This land today supports a farm population of 3,200,000 people. In the industrial field, save for the fact that the population is somewhat more mobile, an even larger problem presents itself. Estimates indicate that the industrial population directly dependent upon export sales is more than twice as large as that en-

gaged in agricultural work. Conservative calculations place it at about 7,500,000. In all, a population of considerably over 10,000,000 people are dependent for their subsistence upon exports of the products of farm and factory."

FOREIGN TRADE AN INDEX OF "PROSPERITY"

When a country's foreign trade declines, its prosperity declines. Foreign markets for its exportable surpluses give a country effective command over the world's resources. They enable it to take part in the progress of the human race. Imports, no less than exports, are an index of a nation's prosperity. Employment has always been highest when imports were highest and lowest when imports were lowest. Imports involve transportation, servicing, processing, manufacturing, and distribution, requiring the employment of millions of people. Imports as well as exports create jobs for our workers. It has been profitable for each nation to develop those industries in which it has a natural or technological advantage beyond domestic needs. In a word, foreign trade is beneficial to all nations of the world.

Conversely, a substantial reduction in export trade sets adrift countless numbers of people who have no place to go except to the relief rolls. As exchange controls and quota systems disappear, international trade relationships become more and more stable. Exporters and importers are able once more to make their commitments without fear of any arbitrary dislocation of their plans. When tariff rates at each end of the trade channels are reduced to sensible and practical proportions, goods from "abroad" will sell for lower prices in both trading countries. This will make for a greater volume of consumption, which means an increase in production activities, to the benefit of the standard of living in the world at large.

SHOULD WE ALWAYS "BUY AMERICAN"?

The slogan, "Buy American," if fully carried out, would mean an abandonment of our export trade. How easily we forget that, when one purchases a dollar's worth of foreign-made goods, he is making possible the potential sale abroad of a corresponding amount of American goods. There is nothing truer than the statement that, in the last analysis, exports can be paid for only by imports.

There is, it must be admitted, a certain plausibility in the argument for a "closed nationalism." In our modern world where fears of war are growing and in which those of us who are working for peace find so much that is discouraging, we are tempted to believe it is best for one country to become economically self-sufficient. Perhaps, we argue, we may thus become immune to the effects of wars between other countries. Unfortunately, it is extremely difficult—next to impossible—even for this vast country of ours to become self-sufficient. Coffee, silk, tin, nickel, manganese, rubber, and a great many other essential commodities must be brought in from abroad. That is the answer. And, to repeat what has already been said, we must look to foreign markets to give employment to millions of our people whose surplus cotton, tobacco, lard, and other products we cannot consume at home.

But, if it is difficult for us, with our infinitely varied conditions of soil and climate, our tremendous resources, and our manifold industrial activities, to be economically self-sufficient, it is impossible for many other countries, both in Europe and Asia, with their dense populations and limited resources, to be thus

independent. If they cannot export the products of their manufacturing industries and trade them for foods and raw materials, and thus achieve national well-being, they will be tempted to engage in wars of conquest to acquire new territories from which they can obtain the foods and raw materials they so sorely need. There is no country in the world which does not have some few special products which are lacking in others. Unfortunately, there can be no surer way to bring about a general war and misery than for the policy of national economic self-sufficiency to be pressed to its logical conclusion.

It is really not good economics to bar even the slightest degree of competition from the imports of any industrial product that can be produced in the United States. Competition very often conduces to excellence. And, in the final analysis, it is not good economics to do everything in the interest of the producer and quite neglect the interest of the consumer.

WHAT DOES THE RECIPROCAL TRADE PROGRAM AIM TO DO?

The objective of the reciprocal trade program is the lowering of American tariffs on certain products from abroad, in return for similar concessions on the part of other nations and a mutual pledge of equality of treatment. Officially the purpose is set forth in the following phraseology from the Act itself:

(Public No. 316–73rd Congress—H. R. 8687. An Act to amend the Tariff Act of 1930)

"Part III—Promotion of Foreign Trade

"Sec. 350. (a) For the purpose of expanding foreign markets for the products of the United States (as a means of assisting in the present emergency in restoring the American standard of living, in overcoming domestic unemployment and the present economic depression, in increasing the purchasing power of the American public, and in establishing and maintaining a better relationship among various branches of American agriculture, industry, mining, and commerce) by regulating the admission of foreign goods into the United States in accordance with the characteristics and needs of various branches of American production so that foreign markets will be made available to those branches of American production which require and are capable of developing such outlets by affording corresponding market opportunities for foreign products in the United States, the President, whenever he finds as a fact that any existing duties or other import restrictions of the United States or any foreign country are unduly burdening and restricting the foreign trade of the United States and that the purpose above declared will be promoted by the means hereinafter specified, is authorized from time to time—

"(1) To enter into foreign trade agreements with foreign governments or instrumentalities thereof . . ."

The Reciprocal Trade Agreement Act, approved by the President on June 12, 1934, as an amendment to the Hawley-Smoot Tariff Act of 1930, authorized the Executive to (a) negotiate trade agreements with foreign governments and (b) withdraw from countries discriminating against American commerce such tariff reductions as might be provided for in the various agreements negotiated under the Act.

In other, less technical language, the purposes of the program are:

1. To break the existing log jam in world trade by leading the nations in the removal of existing barriers to commerce.

2. To reopen foreign markets to the products of American industry and agriculture.

3. To facilitate in the importation of certain foreign goods, not only as "concessions" to foreign nations which have made concessions to us, but to benefit our consumers and raise our standards of living.

ARE THESE OBJECTIVES ATTAINABLE?

It would be difficult to give concrete illustrations of how the first object is being achieved. It is possible, however, to show that, due at least in part to our efforts in this direction, other trading nations are now hesitating to impose new restrictions and are showing themselves increasingly willing to abolish existing ones. That second and third objectives are being realized seems evident when we consider the progress of American trade both ways during the past two years.

MORE TARIFF POWERS TO THE EXECUTIVE

Under the reciprocal trade program the President has been given wider power with respect to tariff than any other president has ever enjoyed. He can raise or lower any and all duties by 50 per cent of the 1930 rate. He is not, however, permitted to transfer any article from the free to the dutiable list, or vice versa. New duties or other import restrictions, it is prescribed, "shall apply to articles the growth, produce, or manufacture of all foreign countries." In other words, the changes are to be "generalized" and are not confined in their application solely to the countries with which agreements have been made. The President's grant of power is temporary, for three years only. Finally, as these trade agreements are not treaties, but executive agreements, it is not necessary to secure confirmation by the Senate before they become effective.

Before a trade agreement is concluded with any foreign government, reasonable public notice must be given so that any interested person may have an opportunity to declare his interest and present his views. The President must "seek information and advice with respect thereto from the United States Tariff Commission, the Departments of State, Agriculture, and Commerce, and from such other sources as he may deem appropriate."

FORMS WHICH "CONCESSIONS" MAY TAKE

In the trade agreements negotiated the concessions sometimes take the form of reduced tariff rates, or "bound" rates, of more liberal quotas, or, perhaps, a surrender of our quota limitations, a more liberal exchange control, or, it may be, the complete release of blocked currencies. The concessions may take still other forms, including that of less rigid administrative policy as regards customs inspections and sanitary restrictions. The conclusion of such agreements requires an extensive fund of information as to market possibilities abroad for every commodity we export and an equally careful study of all commodities, the import of which we are prepared to encourage.

SAFEGUARDS AGAINST GIVING AWAY TOO MUCH

Among the other safeguards against missing fire at the main objective and unduly complicating the procedure, Congress specifically declared that nothing was to be done under the Act "to cancel or reduce any of the indebtedness of any foreign country to the United States."

A safeguard written into the agreements against possible changes in currency value or exchange rates makes an interesting provision. If a considerable variation takes place in the rate of exchange between the dollar and the mone-

tary unit of the other country, which either government considers so substantial as to prejudice the industry or commerce of its own citizens, each is free to propose negotiations for the modification of the agreement. If no agreement should be reached, the government suggesting the change is free to terminate the entire agreement itself on thirty days' notice. So far, happily, it has not been necessary to make use of this liberty. The provision, however, makes it possible for nations to proceed with efforts for the reduction of trade barriers even though they are not sure as to just what may happen in the future to the course of exchange between their currencies.

The Set-up for Carrying Through the Agreements

The set-up for carrying out this policy into practice is adequate but comparatively simple. Next to the President, the major controlling agency is a group of expert officials known as the Executive Commercial Policy Committee, which passes on the general policy to be followed in the negotiation of trade agreements and sits as a court of appeal in the settlement of particular issues which may arise.

The principal working agency, however, is the Committee on Foreign Trade Agreements, which performs the actual labor of formulating the text of each trade agreement. This committee, presided over by an appointee of the Department of State, is likewise composed of representatives of government departments,—State, Agriculture, Commerce, the Treasury, and the Tariff Commission.

The Public Relations, or Hearings, Committee

There is a third committee, known as the Committee for Reciprocity Information, presided over by the vice chairman of the Tariff Commission, and made up of a membership drawn from the various departments of the Government. Referred to as the Hearings Committee, it is really the public relations committee of the program. It is the group to which the business men of the country, whether exporters or importers, present their written or oral facts and arguments as to the way in which they believe the various commodities in which they are interested should be handled.

These three standing committees are supplemented by country and commodity committees and committees on special problems.

The Opposition Attacks Both Motive and Method

In spite of the data and arguments marshalled by the advocates of the program as to the need for such a departure from long followed practice, the opposition takes two general forms, attacking both motive and procedure.

Strange as it may seem, there are many good people who object to any such effort to revive and promote the foreign trade of the United States, because, in their opinion, we don't need it. Then, there are those—a fairly large company—who, while admitting the necessity for trade with the rest of the world, are not in sympathy with the reciprocal trade method. They regard it as, if not vicious, at least unworkable.

Comparative Value of Foreign Trade to Americans

To those who are fond of telling us that, as compared with our domestic business, our foreign trade is really unimportant, that it amounts to only some 10 per cent of our total production the answer is that the value of our foreign trade cannot be measured in any such fashion. To say that trade with for-

eign nations is unimportant will certainly not satisfy our cotton growers who, for lo, these many years, have sold from 50 to 60 per cent of their entire crop abroad. This business has meant to them the livelihood of nearly twenty millions of people in our country. Considering cotton alone, half a billion dollars' worth of buying power is what this foreign business means to our South. Also important in our export trade are tobacco, motor cars and trucks, machine tools, chemicals, and many other commodities, which have export values sufficiently high to make them of real importance to the well-being of the industries affected. A national policy directed toward the maintenance or increase of these exports should encourage the return flow of foreign goods, which makes the exports possible.

UNILATERAL TARIFF REDUCTIONS OR RECIPROCAL AGREEMENTS?

In our effort to reduce trade barriers, we could choose one of two technical courses. We could make a general reduction in our tariff rates and hope that other countries (most of which had gone wild with obstructions to trade) would follow our example. Not only could we have no assurance that this would happen, but it seemed beyond hope. The other course was to make reciprocal agreements for the mutual reductions of barriers. This is what Secretary Hull decided to do. Hence the program. Under its terms, as the secretary pointed out, in an address before the American Farm Bureau Federation in December, 1934, "increased imports will be stimulated on the basis of causing the least possible disturbance to domestic production. The most careful and scientific study by experts will precede the reduction of duties on our part and the removal by others of barriers obstructing our trade."

OUR TRADITIONAL TARIFF POLICY UP FOR REËXAMINATION

It took courage to plan, initiate, and defend the program in the face of our traditional tariff policy. For more than a century and a half this policy has been, preponderantly, a policy of "protection" as against "free trade," of high tariff rather than low, of "nationalism" rather than "internationalism." There have been lapses from this faith, it is true, but they have been lapses only. In 1933 the general tariff walls of the United States were at their highest. This, said Secretary Hull in a recent address, is "precisely the reason why, despite its many other claims to the attention of posterity, the Seventy-third Congress may yet be remembered by historians principally for its H. R. 8687, the bill that authorizes the negotiation of reciprocal trade agreements with foreign nations. For therein sprouts the germ of a reversal of a century and a half's policy."

PAN-AMERICAN SENTIMENT FOR PROMOTING FOREIGN TRADE

The launching of the program of the reciprocal trade agreements has found an increasingly favorable sentiment among all the states of the two American continents. At the Seventh International Conference of American States, at Montevideo in 1933, resolutions were adopted concerning the identity of interests among the signatories in the promotion of foreign trade. Currency stabilization and the removal of trade barriers were seen as the only way back to a larger world trade. At the Conference at Buenos Aires in December similar conclusions were reached. The new quotas and exchange restrictions, inspired through currency fears, can be removed only if these fears are dispelled. With currency stabilization attained, it

is not difficult to see that exchange restrictions and quotas, imposed for currency reasons, will tend to disappear. And consequently, these obstacles to the negotiation of reciprocal trade agreements would no longer be insuperable.

THE MUCH DISCUSSED "MOST-FAVORED-NATION" POLICY

Some loud-spoken opposition to the trade agreement program has been directed at the procedure of generalizing concessions made to the agreement countries to others, with which we have most-favored-nation treaties provided always that these "third" countries do not discriminate against American commerce.

Equality of treatment is not a new principle with us. Since Washington's day, this policy, otherwise known as the most-favored-nation policy, which has been tested and proved by experience, has been at the foundation of American commercial practice.

Historically, the equality-of-treatment policy has formed the basis of most of the trading of the past hundred years all over the world. This is the policy which has been woven into "a network of hundreds of treaties all over the world, whereby each party agrees to give to the other the same commercial treatment as that accorded to the most-favored-nation." Today the United States is a party to treaties or agreements containing the most-favored-nation clause with some 45 nations and most of these pacts are of long standing.

Those who now advocate replacing this with a policy of preferential bargaining, do not, it would seem, realize that such a policy means the shifting and adjustment of the currents of world trade, not in response to the operation of the economic forces of supply and demand, but according to political decisions and often arbitrary acts of governmental officials, sometimes by a country's own officials and sometimes by those of other nations over whom it has no control.

SOME DISTINCT ADVANTAGES OF THE METHOD

This method of most-favored-nation concessions has its distinct advantages. If we do not follow this policy, more than 30 commercial agreements with various countries of the world based on this policy would have to be scrapped. A policy of discriminating tariffs on our part would not only prevent the United States from objecting to discriminations now in force against our trade but would provoke retaliation in the form of new barriers or discriminations. The unconditional most-favored-nation policy, it is believed, broadens the base of all trade relations, and thus helps to reduce restrictions and limitations between nations generally, with a resulting increase in international trade as a whole.

HOW THE SAFEGUARDS WORK IN PRACTICE

The authority to exclude certain countries from most-favored-nation privileges has already been used in several cases. Several features of the German foreign trade control had been found to operate "discriminatingly" against American goods. Therefore, on October 15, 1935, when most-favored-nations obligations to Germany expired, the President announced that the benefits of concessions would be withdrawn from that country. In addition, since it was found that the recent trade diversion policy of Australia was resulting in discrimination against American trade, it was announced that, after August 1, 1936, generalization of concessions granted in trade agreements would not be extended to Australia. Recently agreements were concluded

with Czechoslovakia, Russia, and Ecuador which are interesting in this connection. These countries, in return for assurance that the United States would extend to them the benefits of concessions granted in the course of trade agreements with other countries, promised the removal of any discriminations against American trade. Russia, for her part, promised that the Government Foreign Trade Monopoly would increase its annual purchases from the United States.

A Procedure of Give and Take

Naturally, to obtain trade concessions, in tariff rates and other particulars, we have had to give something in return. In this connection it is interesting and somewhat surprising to note the criticism that, because in 1935 (after American stocks had been depleted by the 1934 drought) we imported agricultural products, it was due to the trade agreements program and that these imports will continue—and increase—to the peril of our farms and ranches.

In this connection it is well not to forget, as Secretary Hull recently pointed out, of the 274 million dollars' increase in agricultural imports last year, only 13 million dollars' worth had any relation to trade agreements, the rest being in non-competitive products or commodities needed as a result of the 1934 drought. While it is admitted that recently there has been an increase in our agricultural imports, the figures do not show, as has been claimed, that our farmers are being injured or that a "stream of foreign agricultural products is pouring into the country."

The value of all our agricultural imports in 1935, was $400,000,000 greater than it was in 1932, when it reached the lowest point in a generation. More than half of this increase, however, was accounted for by three factors: (1) the expansion of our foreign purchases of such indispensable raw materials as rubber, silk, hides and skins, and wool; "such increased purchases really being indicative of a growth of industrial activity and employment"; (2) expansion of our foreign purchases of such foodstuffs as coffee, tea, spices, sugar, and tropical fruits, indicative of a growth of consumption of these products, resulting no doubt from rising employment, wages, and profits; and (3) a rise in our imports of alcoholic beverages, resulting, of course, from the repeal of the Eighteenth Amendment. "Less than half of the total increase in our agricultural imports was accounted for by what, under normal conditions, would have been more or less competitive commodities." (The quoted phrases are from State Department releases.)

Import Quotas and Exchange Controls

In dealing with two of the non-tariff restrictions in trade import quotas and payment for goods under exchange controls, the procedure is interesting and significant.

It has proven very difficult to get rid of import quotas. Our American negotiators, however, have endeavored to secure for American exports products so restricted in foreign markets a share in the total quota of the other country in proportion to the amount supplied by the United States during a preceding period which was not restricted.

Then there is the vexing question of exchange control. In certain markets there are great difficulties in getting payment for goods because of these controls. In the agreements already concluded American trade is promised a "fair and equitable" share in the allotment of exchange, when it is controlled, and this share "shall not be less than the share employed in a previous representa-

tive period prior to the establishment of any exchange control."

THE CHARGE OF "STAR CHAMBER" METHODS

A persistent charge against the method of negotiating the reciprocal trade agreements is that it is a "star chamber" procedure—that the negotiating is done in secret and that business men who are very much concerned have no knowledge of what is being considered until the agreement is concluded.

As a matter of fact, all interested persons have opportunity to be heard. Obviously it is impossible to conduct the actual negotiations in public. The bargaining and haggling over rates and the gradually whipping into shape of the agreements must necessarily be done behind closed doors. In enacting the Trade Agreements Act, no doubt, Congress remembered the highly technical character of all tariff revision. It was also, of course, mindful of the log-rolling process which in the past has made it almost impossible for Congress itself to revise the tariff in any direction except upward. Therefore, it entrusted the task of tariff revision, within strictly defined limits, to the chief executive.

As to this charge of "secrecy," Mr. Thomas Walker Page, vice chairman of the Tariff Commission and chairman of the Committee for Reciprocity Information (the Hearings Committee already described), has pointed out that, in connection with the eighteen countries with which negotiations have been undertaken (up to December, 1936) there have been received for consideration, some 2,500 written statements while the oral testimony at the hearings has covered upwards of 3,000 pages. Mr. Page ventures to comment that, "in the preparation of these trade agreements there has been less secrecy and more opportunity for interested parties to present their views than there has been in any tariff revision for more than 100 years."

A BUSINESS PROPOSITION—NOT SENTIMENT

Other captious critics endeavor to make it appear that the policy of equality of treatment, treating all countries alike, provided they do not discriminate against us, is a sort of sentimental doctrine of internationalism—giving away something for nothing.

Of course, it is nothing of the sort. The concessions granted to a particular country under the trade agreements is extended also to other foreign countries if they do not discriminate against our commerce. But we don't give these things for nothing. Far from it. We demand the same equality of treatment for ourselves. The result is that our export trade is constantly falling heir to extensive benefits from other countries without any specific concession in return from us.

SOME OF THE RESULTS SO FAR

There has been an insistent and growing demand for data—statistics—to prove the benefits of the program so far as our export trade is concerned.

Reducing trade barriers by negotiation with individual countries is from its very nature a gradual one. Its effects are not to be measured by quick and general statistics. "So many incalculable factors and temporary causes divert the shifting currents of foreign trade that it is impossible to measure, within a year or two of its coming into force, the actual results of a trade agreement with any kind of scientific accuracy. Nevertheless, such evidences as we have indicate an unmistakable and continuing gain in American foreign

trade, in no small degree attributable to the trade agreements program." *

We have now signed trade agreements with 14 foreign countries. These fourteen countries normally take nearly 40 per cent of our export trade. They all sell in the United States certain specialties which cannot presumably be so economically obtained elsewhere.

While the full force of the program cannot be measured until the number of agreements has increased and the currents of trade have had time to take advantage of the diminished barriers to our commerce, some estimate is now possible.

After intensive study of the needs of American industry, it has been considered possible and advisable to grant certain concessions on many of the typical specialties of the countries with which agreements have been concluded.

In return for these, concessions of importance to our own export industries have been obtained. In nearly all of the 14 agreements there are constantly recurring concessions from the foreign countries concerned on American specialties, such as cotton, tobacco, fruits, vegetables and other agricultural products, naval stores, automobiles, office machines, patent leather, certain tools and hardware, electrical refrigerators and other electrical household equipment, etc.

The trade agreement countries fall into three groups:

(1) Brazil, Colombia, Haiti, Honduras, Guatemala, Nicaragua, and Sweden. They supply us principally with duty free raw materials, although Sweden does send us also some semi-manufactured articles duty free. This group, with the exception of Haiti and Nicaragua, sells much more in the United States than it buys from us. Therefore, we were in a strong bargaining position with them, and our concessions consist largely of promises not to impose any duties in the future.

(2) Cuba and Canada are special cases. We have had a reciprocity treaty with Cuba for many years. The island has made large concessions in exchange for reductions in our tariff.

(3) The others, France, Belguim, Switzerland, The Netherlands, and Finland, have nothing much in common. However, they set the test of the final success of the program. Just what will we do in the way of making agreements with twenty-seven European countries which are still the principal markets for American export and the principal source of our dutiable imports? Taken together they buy between 45 and 50 per cent of all American goods shipped abroad and furnish almost the same proportion of our imports subject to tariff duties. Moreover, they are the chief offenders in the way of artificial restrictions on trade.

TRENDS, AS INDICATED BY THE WORKING OF THE AGREEMENTS WITH CANADA, CUBA, AND BELGIUM

Three agreements have now been in operation long enough to enable us to see how trade has been affected by them. The agreement with Canada has its own meaning by geography and population. That with Cuba has certain special features, because of our relation to the island republic. That with Belgium supplies the evidence from the angle of an industrial country on the continent of Europe. Studies of the statistics of trade in each case are constantly being made and will be released from time to time. One thing can be said now. Statistics show that trade between the United States and each of these countries has improved more noticeably since

* Assistant Secretary of State Sayre in a recent public address.

the agreement came into operation than has the trade of each with the rest of the world. While, as yet, there has not been sufficient time to generalize very confidently, on the whole, we know enough to say that Secretary Hull can claim that in our agreements with these three countries, we have accomplished, measurably, the two main purposes of the program. We have stimulated our own exports and aided in import trade in certain foreign specialties without undue harm to American industry.

How Much of Our Increased Imports Is Due to Agreements?

It is not possible to state definitely how much of the increase in the value of our imports has occurred as a result of tariff concessions, because of the other factors operating to increase imports. It is, however, possible to estimate the maximum gain in the value of imports attributable to the trade agreements program. Our total imports during 1935, upon which duty reductions to foreign countries were in effect at the end of that year, according to Department of Commerce figures, were valued at approximately $110,000,000. The value of these same imports in 1934 was $79,000,000. It will thus be seen that, even if all of the increases in imports of these concession commodities were attributable to the trade agreements program, the increase was not more than $31,000,000, or some two per cent of the value of imports in 1934. However, other factors above were undoubtedly responsible in part for the increase.

Warding Off Future Troubles

Forewarned, says the old saw, is forearmed. The trade agreement policy, it is believed by its advocates, is serving a useful purpose in tending to prevent many of the worst trade obstructionist policies of foreign countries from becoming "frozen" into permanent form, or at least into such a nearly solid state that, if the program were deferred much longer, they could not be thawed out. Suppose we were to hold another World Economic Conference—say, in 1940—would we of the United States have more than the slimmest chance of attaining anything worth-while, if, at such a conference, we found the other trading nations so tied up with bilateral agreements as to leave us quite on the outside looking in? During the past three years so many and such extraordinary devices have been adopted for blocking trade, in self-defence, by countries which had never before even dreamed of such measures, that, if we waited much longer, we would have to accept much less by way of exchange than if we began something at once. It seems desirable, even necessary, to break the log jam now. We have at least made a beginning.

LAND USE CHANGES IN THE BISHOP AREA OF OWENS VALLEY, CALIFORNIA

Ruth E. Baugh

THE northern part of Owens Valley, once a highly developed agricultural area, today presents a scene of desolation. Land formerly productive has returned to sage brush, and commodious farm buildings are now in ruins. Weed-choked irrigation ditches, abandoned farm machinery, and rows of stark, bleached tree trunks identify the sites of former ranches. In the vicinity of Laws the devastation is complete, but in the West Bishop area a few scattered ranches remain intact; they serve to accentuate the contrast between the desert and the sown, and help us to visualize with the aid of land classification maps of former years the probable appearance of the cultural landscape when the area was a highly productive and normally functioning community. The abandoned farm in California is not unique, but general abandonment of farms throughout an extensive region, such as one sees today in northern Owens Valley, is unusual.

The destruction of agriculture in the region followed the withdrawal first of surface water and later of underground water by the City of Los Angeles. Water was diverted from the natural drainage basin of Owens River to augment the municipal supply of Los Angeles, a city nearly 300 miles away. The consequent increase in water resources enabled Los Angeles to embark upon a notable period of expansion; on the other hand, the loss of its water supply, the critical resource in its economic life, arrested the normal development of Owens Valley. Land rapidly reverted to desert, population dwindled, school districts lapsed, and even the function of the valley towns altered as surrounding cultivated land, farm by farm, was purchased by the City of Los Angeles and passed from private to public ownership.

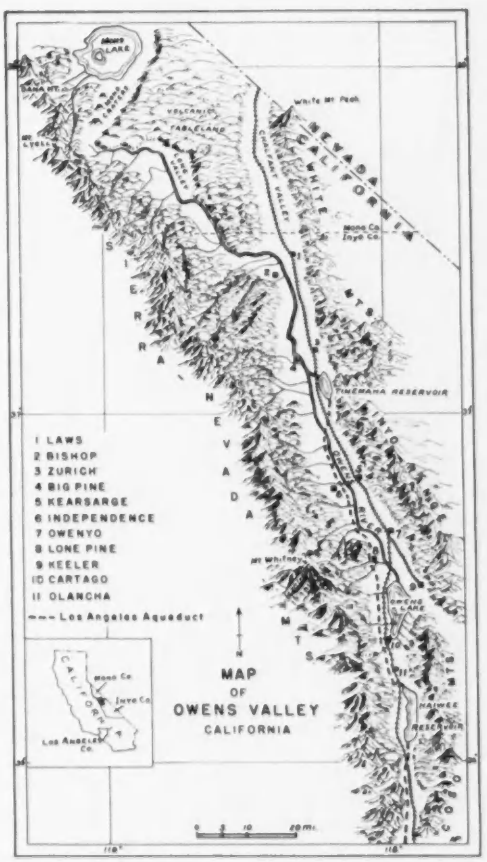


FIGURE 1.—Owens Valley, westernmost of the longitudinal troughs of the Basin and Range province, is walled in by the White Mountains—Inyo Range on the east and the High Sierra on the west. Mt. Whitney overlooking Lone Pine rises to 14,495 feet and White Mountain Peak, highest point of the eastern range, attains an elevation of 11,321 feet. Owens Valley extends from the volcanic tableland north of Bishop to the south end of Owens Lake.

SITUATION AND RELIEF FEATURES

Owens Valley, the westernmost of the longitudinal structural depressions of the Basin and Range province, is located in northern Inyo County in east-central California. It is a region of bold impressive scenery. The narrow trough is immured by the high forbidding Inyo Range which with the White Mountains forms the eastern wall of the valley 110 miles long (average elevation 10,000 feet), and by the lofty rugged escarpment of the Sierra Nevada on the west which towers 10,000 feet above the valley floor and culminates in Mount Whitney (14,495 feet). The valley is drained by Owens River which emerges from a gorge cut through a lava flow and enters the rift section a few miles north of Bishop. From this point (4,500 feet) the valley floor slopes gently southward for 75 miles to the undrained depression of Owens Lake, the lowest point of the valley (3,600 feet), formerly an extensive sheet of saline water, but since the diversion of its feeders into the Los Angeles Aqueduct, a salt-encrusted flat.

The valley varies in width: in the vicinity of Tinemaha Reservoir it is barely four miles wide, while in the Bishop area it expands to fifteen miles. Between the level valley floor and the

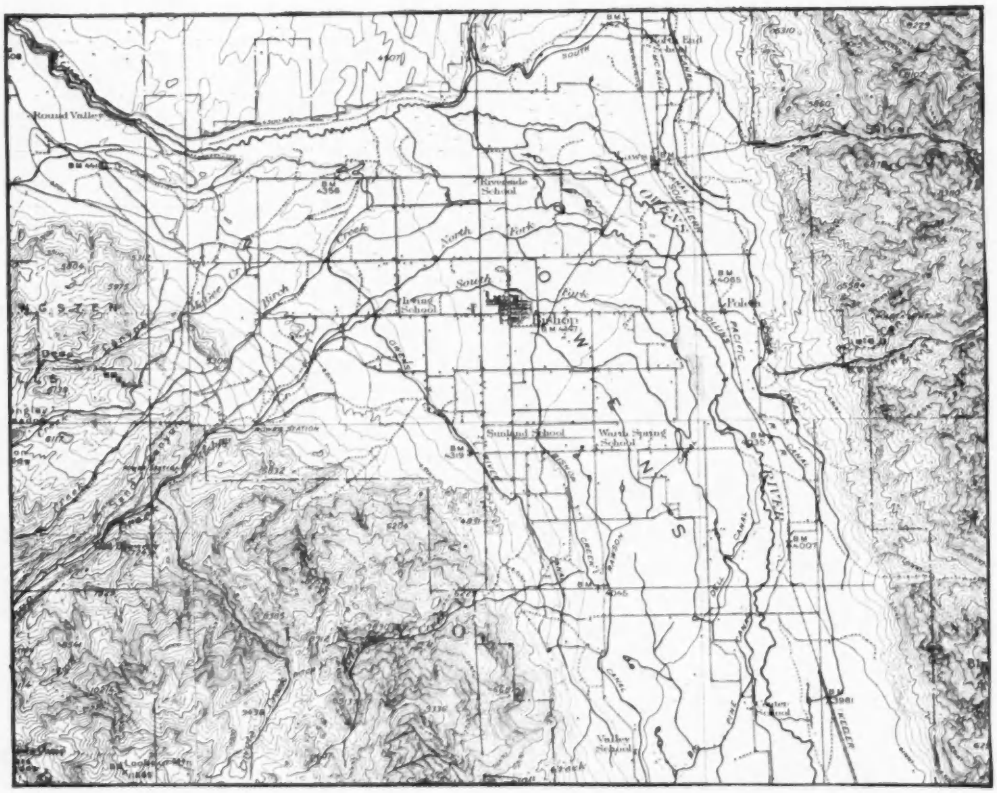


FIGURE 2.—The Bishop Area of Owens Valley. Owens River emerges from a gorge cut through the volcanic tableland northwest of Bishop. In this vicinity Owens Valley expands to its greatest width and several perennial creeks from the Sierra Nevada converge on the valley floor. An extensive canal system, begun in the late seventies, irrigated the lands of this area. Here was concentrated the largest block of cultivated land, the densest rural population of Owens Valley. The canals have ceased to function since the wholesale purchase of land and the acquisition of water by the City of Los Angeles. (Map based on Bishop and Mt. Goddard quadrangles U.S.G.S. Surveyed in 1910 and 1911. Edition of 1913.)

FIGURE 3.—The southern entrance into Owens Valley south of Lone Pine. The escarpment of the Inyo Mountains on the right and the east slope of the Alabama Hills, a low range of mountains near the base of the Sierra Nevada on the left.

base of the bordering mountains broad alluvial fans create a barren boulder-strewn piedmont, almost continuous at the foot of the Sierra, but occurring as more isolated, high-pitched cones at the outlets of the canyons that break the face of the White-Inyo range.

In form and geomorphology Owens Valley is similar to other desert basins of eastern California: Saline, Panamint, and Death valleys; but it differs in one important respect, a feature which has great geographic significance, Owens Valley is a region rich in waters, surface and underground.

CLIMATE

The floor of the valley in the rain-shadow of the Sierra receives a scanty rainfall. Bishop (elevation 4,450 feet) has an average annual precipitation of 6.05 inches, 82 per cent of which falls between October and April. Southward the precipitation decreases: Independence (3,957 feet) receives 4.83 inches, while Keeler (2,622 feet) east of Owens Lake flat records only 2.98 inches. With increase of elevation west of the valley, however, precipitation grows steadily heavier. Only fifteen miles west of Bishop, Bishop Creek at an elevation of 8,300 feet receives 15.42 inches, with an average seasonal snowfall of 134.7 inches, according to Section 18 of the Climatic Summary of the United States—Southern California and Owens Valley. Climatic data are lacking for points along the summit and the high eastern slope of the Sierra Nevada. Winter snowfall is generally heavy on the peaks overlooking Owens Valley, and in high protected recesses of canyons and lake basins snow remains throughout the summer. South Palisade Glacier, southernmost glacier in the United States, feeds Big Pine Creek, an important tributary of Owens River.

WATER SUPPLY

It is from Sierran sources solely that the waters of Owens Valley are derived. From the Inyo Mountains on the east a meager and intermittent supply reaches the lowlands, an amount too small and undependable to be of economic significance.

The headwaters of the trunk stream, Owens River, tap the east slope of the Sierra Nevada—the area south of Mono Basin divide and the numerous highland tarns in the Mammoth Lakes basin. Somewhat farther south the waters from an extensive area along the Sierra

divide bordering Fresno and Mono counties gather in Long Valley and join the stream, thereby adding to the volume of the river just before it enters the gorge cut through the lava flow which separates the upper valley from Owens Valley proper. (Owens Valley is the name applied to that part of the narrow rift valley south of the volcanic tableland and extending to the south end of Owens Lake, as shown on the Bishop and Independence quadrangles, U. S. G. S. series.)

FIGURE 4.—The east slope of the Sierra Nevada under its winter mantle of snow. Streams emerge from the many canyons of the Sierra and join Owens River. View on the river above the intake of the Los Angeles Aqueduct south of Big Pine. (Courtesy of Department of Water and Power, City of Los Angeles.)

A major tributary, Rock Creek, joins Owens River near the outlet of the gorge northwest of Bishop. Here the valley expands to its greatest width; here also several perennial creeks flow over wide alluvial fans and converge on the lowland near Bishop and Laws. As a result of the abundance of water in this expanded end of the valley and the ease with which irrigation waters could be diverted, the Bishop-Laws area became more extensively utilized for agriculture than any other section of Owens Valley. In this vicinity was concentrated the largest block of cultivated land and the densest rural population, and here the largest town of the valley, Bishop, developed. It is natural, then, that this section, having advanced farthest in agricultural utilization, should have suffered more seriously than other valley districts from the effects of water withdrawal.

South of the Bishop area, at fairly regular intervals, perennial creeks emerge from the granite-walled canyons of the east face of the Sierra, cross the alluvial fans and join Owens River. These streams formerly irrigated farms from Big Pine to Lone Pine, but today they feed the aqueduct. An appreciable percentage of their volume, however, joins the underground water supply. The smaller creeks disappear entirely in the loose fragmental materials and even the larger streams diminish in volume, thereby adding to the natural storage reservoir underlying the valley.

The ground water surface lies not far below the land surface; moreover, in widely scattered areas flowing wells indicate a water supply under hydrostatic pressure. Most of the wells observed

by W. T. Lee during his study of water conditions in 1904 were flowing. C. H. Lee made a detailed investigation of wells in the Independence area between 1908 and 1911, and reported that many were flowing. During the summers of 1933 and 1935 the large wells belonging to Los Angeles, equipped for pumping, were flowing naturally and discharging into the aqueduct. In certain sections of the Bishop district today, where alfalfa fields have succumbed to drought induced by the diversion of surface water, patches of growing alfalfa persist, subirrigated by seepage.

FIGURE 5.—Owens Valley south of Independence, California. A study in contrast between mountain and plain.

The apparent anomaly of widespread areas of verdant grassland, spongy ground, and swamp vegetation in a general landscape of pronounced aridity, seems to have impressed early visitors to the valley who passed "alternately through expanses of natural meadow and desolate reaches of sage." No less surprising to present-day motorists enroute to Sierra summer resorts is the sight of blighted farms in a region apparently wealthy in waters.

EARLY UTILIZATION

The natural grasses provided the basis of the first utilization by Americans. Early explorers and immigrant parties enroute to the coastal settlements utilized the long corridor of Owens Valley where water and pasturage were abundant. Gold seekers outbound from Salt Lake to the mines of the Mother Lode were often deflected by the snowbound northern passes of the Sierra southward to Walker Pass by way of Owens Valley. Immigrants who braved the terrors of Death Valley took renewed courage when they emerged from the Panamints and came out on lower Owens River. Although isolated from the greater part of California, nevertheless, the alignment of a narrow corridor of easy gradient between two high parallel barriers, predestined Owens Valley a transit region. This is a geographic fact of paramount significance, not only in the early period of settlement, but in the present period of adjustment to changed conditions consequent upon the destruction of agriculture.

Owens Valley became the thoroughfare for hundreds of miners who trekked northward to Monoville in 1859, and the year following to Aurora. Prior to 1861 travelers were mainly prospectors. Accompanying them or following soon after walked the meat supply. Food was in great demand and the distance to markets great. Herders driving livestock north to the mining camps could not fail to be impressed by the excellent grazing possibilities in the Bishop area. The opening of mines in the Coso, Inyo, and White Mountains continued to attract a transient mining population with increasing demand for all supplies, particularly food and lumber. By 1867 fourteen quartz mills were operating in the mountains adjacent to the Valley.

Home seekers joined the miners. From Mother Lode mining camps, Tulare plains, and Los Angeles County, settlers followed the trails that led to Inyo—over Walker Pass or the desert path northeast of Mojave. Scattered homes appeared up and down the length of the valley. By the close of the sixties, 5,000 acres were under cultivation and livestock grazed the plains.

One deterring element, however, retarded the progress of the region. Recurrent attacks by hostile Indians not only diverted the attention of the settlers but actually forced the abandonment of land, particularly in exposed locations. The killing of Americans and the destruction of property led United States Army officials to establish a garrison at Camp Independence. Intermittent trouble with the Piutes continued until 1866–67, when the Indians quieted down, although spasmodic outbreaks occurred as late as 1870. With eventual settlement of the Indian uprising, immigration into Owens Valley was resumed.

BEGINNINGS OF AGRICULTURE

Land was first cultivated on the intermediate levels of the alluvial fans where water could be diverted easily from the creeks. Inyo County reported 4,988 acres of improved land and 73 farms in 1870, according to the Ninth Federal Census of 1870. (Agricultural statistics for Inyo County are practically synonymous with Owens Valley, inasmuch as Owens Valley, with insignificant exceptions, is the only cultivated and inhabited area in the county.) Homesteaders continued to arrive and file on land, pushing north beyond Laws, into Round Valley and

FIGURE 6.—Summer haying on the Barlow Ranch, West Bishop, 1935. One of the few ranches remaining in private ownership on the Bishop Creek fan. Abandoned farmlands practically envelope the Barlow Ranches.

West Bishop. New mining centers opened, thereby increasing demand for valley produce. Waucoba, Darwin, Panamint, and Cerro Gordo were thriving mines during the early seventies, producing silver, gold, lead, and zinc. Surplus produce of valley farm and range could only partially supply the demand of the mountain communities.

bined length of the canals had increased to 110 miles, most of which was in the north end of the valley, the center of agricultural development.

The improved facilities for irrigation tempted ranchers to experiment with more varied crops. Orchards and vineyards were planted on the high relatively frost-free alluvial fans just below the

FIGURE 7.—Road between the holdings of the Barlow brothers in West Bishop. Lands are irrigated from Bishop Creek.

As cultivated land in grain and hay expanded, stock was shifted to the upland meadows of the Sierra in summer and in late fall returned to valley stubble fields and pastures. Transhumance, as practiced in Inyo and Mono counties, has always been a profitable adjunct of lowland farming.

The most notable development during the late seventies was the digging of canals in the Bishop-Laws-Big-Pine section to enlarge the irrigable area. A true community project, the owners of lands to be irrigated built the ditches. One of the first to be completed diverted water from Fish Slough to the farms at Laws. The McNally canals served the same district, and Bishop Creek ditch watered the area between Bishop and the river (Figure 2). The report of the assessor of Inyo County for the year 1894 lists seven canals with a total length of 90 miles.[1] By 1905 the com-

[1] Reports of the Assessor of Inyo County. Inyo County Records. Independence, California.

highest canals. By 1900, 32,000 fruit trees were bearing. The 88,500 bearing and 73,500 non-bearing fruit trees reported in 1915, point not only to proven success but to confidence in the future. Dairying became increasingly important as valley towns grew and a new group of mining centers—Tonopah, Goldfield, and Rhyolite—opened in Nevada.

The gradual upbuilding of a homeland in this frontier region was accompanied by progressively improved social features. The first school, organized in 1866, was supported by popular subscription, as was the first academy. As early as 1869 a church with a resident minister served Bishop; the number has increased. Before the period of consolidation elementary schools functioned in every farming district, particularly in the Bishop-Laws-Round Valley area, while in the towns union high schools were organized, and are still maintained despite curtailed enrolment.

The four market towns which emerged, Lone Pine, Independence, Big Pine, and Bishop, developed on the west side of the valley, near the foot of the Sierra where water was abundant. Bishop, the largest town, grew up in the area of most extensive cultivation. The town has far-reaching connections: northwards through Chalfant Valley with the settlements around Walker, Carson, and Humboldt lakes; with Lake Tahoe and the region near Carson City and Reno; and northwestward to the passes of the central Sierra. From Bishop trails and roads diverge to scattered mining properties and to the recently developed summer resorts of the eastern Sierra.

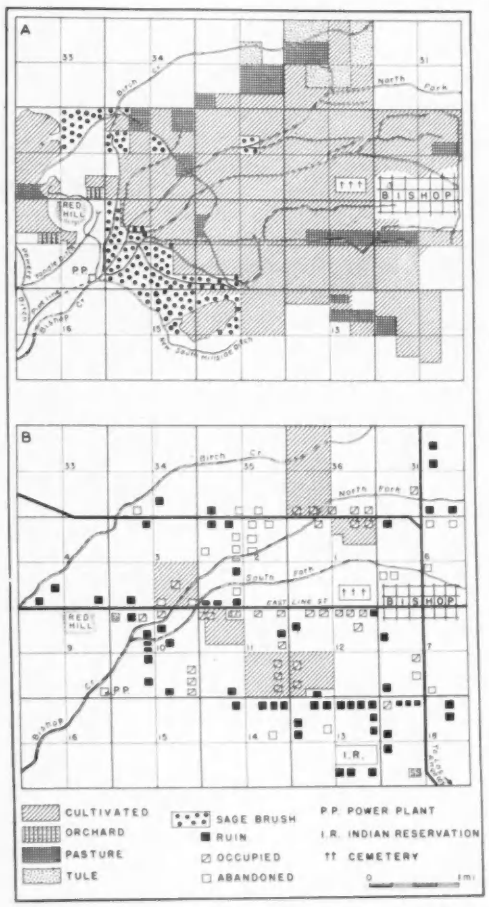


FIGURE 8.—A. Cultivated lands in the West Bishop Area in 1920. Adapted from map of the U. S. Reclamation Service showing classification of lands prepared to accompany the Conkling Report, 1921. (Property of the Department of Water and Power, City of Los Angeles. Used by permission.)

B. Cultivated lands remaining in the West Bishop Area in 1935. Nearly all of the unshaded area is now the property of Los Angeles. The large number of abandoned farmhouses and remnants of habitations points to a numerous former population.

The improvement of communication facilities has in a degree overcome the isolation of the valley. Naturally remote, the valley has become more accessible during recent decades. Transportation during the heyday of Cerro Gordo was by slow, arduous freighting teams from Los Angeles. The first railroad into the valley, however, was built from the north. In 1883 a narrow-gauge line, the Carson and Colorado, was constructed from Belleville, Nevada, over the White Mountains and into Owens Valley. From Benton the line extended south through Laws, keeping to the east side of Owens River near the base of the White-Inyo Mountains. Avoiding the agricultural settlements on the western border of the valley, the railroad was obviously built in the interests of east-slope mines. It terminated at Keeler on Owens Lake. Small railroad stations grew up on the east side of the valley opposite, and connected by road with the main market towns on the west side. Thus, Laws became the shipping point for Bishop; Zurich for Big Pine; Kearsarge for Independence; and Lone Pine Station for Lone Pine. In 1895 the Southern Pacific acquired the Carson and Colorado, and fifteen years later, while the Los Angeles Aqueduct was under construction, the company built a standard-gauge railroad north from Mojave to Owenyo, giving Owens Valley continuous rail connection with Los Angeles. But most of Owens Valley traffic today passes over the wide paved highway, El Camino Sierra, a major north-south thoroughfare of the State of California.

EXTENSION OF MUNICIPAL WATER SOURCES TO OWENS VALLEY

While Owens Valley was laying the foundation of a more or less self-sufficient community, the City of Los Angeles was beginning to rouse from a century of lethargy. The first real estate boom in 1887–88 accounts for the 350 per cent increase in population for the decade 1880 to 1890. By 1900 the number of inhabitants had risen to 102,479 and during the next decade (1900 to 1910) it had reached 319,198. The city's water problem, always a pressing one, became critical in 1903 when the limited supply derived from Los Angeles River failed to keep up with the increasing demands. To aggravate the situation, a series of dry years began in 1893 and continued with little respite until the winter of 1904.

A water famine seemed imminent. City officials and water commissioners began considering the enlargement of the water supply. They first investigated available sources in valleys adjacent to Los Angeles, but decided that the appropriation of nearby sources would be robbing Peter to pay Paul. Curtailment of the natural expansion of tributary territory obviously would react unfavorably on the economic development of Los Angeles.

The quest for water finally led officials to distant Owens Valley. There they found that the United States Reclamation Service was considering the establishment of a project for the irrigation of lands near Bishop and Big Pine. Already 565,480 acres of land surrounding proposed reservoir sites had been withdrawn from entry by the Department of the Interior. Local farmers and business men welcomed the interest of the federal government in their valley and were coöperating to the extent of waiving their storage and other rights along Owens River for the far-reaching benefits expected from a government-developed project.

FIGURE 9.—A deserted farm (Newlan Ranch) near Big Pine in 1933, entering upon a brief period of dissolution which will end in annihilation. Surface streams diverted, the pump, one of scores in Owens Valley belonging to the Department of Water and Power, is the means of sucking out the remaining water from the underground basin. The progress in destruction of this farm may be seen in the following photograph taken two years later.

But on the arrival in the valley of Los Angeles' representatives, the Reclamation Service was soon convinced of the urgent need of additional water in the southern city. It abandoned its plan and surrendered to Los Angeles reconnaissance surveys and preliminary works. Shortly thereafter (1907) the citizens of Los Angeles voted in favor of a bond issue for $23,000,000 for the construction of an aqueduct for the

transference of Owens River water to Los Angeles. In October, 1913, the 235-mile aqueduct was finished and water from Owens Valley commenced pouring into the terminal reservoirs located in San Fernando Valley.

The increment of water came at a critical time in the city's development. Commerce and industry were expanding: the former stimulated by harbor improvements at San Pedro and by the completion of the Panama Canal which encouraged intercoastal trade; the latter by the development of hinterland resources, a great building boom, and the demands of a rapidly growing population. From a population of 319,198 in 1910, Los Angeles increased to 576,673 in 1920. It is obvious that without an adequate and dependable water supply the normal growth of the city would have been seriously hampered.

FIGURE 10.—Ruins of Newlan Ranch in West Bishop district, in 1935. Place entirely deserted, farmlands abandoned. Foundation, chimney, and walls of stone pantry alone remain. All barns and out-buildings moved off ranch. Compare with Figure 9, which is a view of the same farm.

EFFECTS ON OWENS VALLEY

But security for Los Angeles spelled ruin for Owens Valley. The gain of Los Angeles cost Owens Valley the social and economic accomplishments of the sixty-year struggle with a none-too-friendly environment. It is true that agricultural production and business were at first stimulated, particularly during the period of aqueduct construction. The Bishop area as seen by the writer in July, 1916, was a land flowing with milk and honey. From the railroad station at Laws to the town of Bishop and west to Red Hill one traveled tree-lined roads through a district almost continuously cultivated; green fields bordered by wide irrigating canals alternated with stretches of damp pasture lands. Creeks brimful of sparkling water dissected the piedmont sloping to Owens River. A verdant land, Owens Valley presented a scene of substantial economic well-being and human contentment. How different today the area, vacant and desolate!

Fully to understand the undermining and eventual destruction of the pattern of economic life in the Bishop area requires a brief statement of the manner of water acquisition. No lands have ever been condemned outright for the purpose of obtaining the attached water rights. Instead, land has been purchased, farm by farm, until today Los Angeles owns practically the entire Owens Valley.

During the first five years of aqueduct

FIGURE 11.—Abandoned apple orchard at Manzanar, 1935. Unirrigated for three years, the trees are succumbing to drought as sands drift through the rows obliterating all signs of cultivation.

operation, water was diverted from the river into the intake 30 miles *below* Bishop, a practice which did not interfere with the customary irrigation in the upstream area. But increasing municipal demands combined with several years of subnormal rainfall prompted the Water Bureau to enlarge the water crop. In 1918 it began drilling wells. Noticeable inroads into the underground water supply of the lands around Bishop followed a period of pumping. Further enlargement of the aqueduct supply followed in 1920–21 when the city began buying property and acquiring irrigation canals in the Laws area, a policy continued and extended by wholesale purchase of farm and town property in other parts of the valley.

Acquisition of valley land proceeded not without strife and extreme bitterness. Lack of agreement over the prices of land has involved the city in almost continuous litigation during the land-purchasing program. Valley residents claim, apparently with full justification, that the unwillingness or inability of Los Angeles to announce a definite policy regarding the water situation is the basis of the controversy. A feeling of insecurity has long pervaded the area: ranch improvements were curtailed and finally ceased, real estate values declined until property, both town and rural, was unsaleable; business as well as farming stagnated.

Owens Valley citizens conceded the moral principle "the greatest good to the greatest number" applied in their relations to Los Angeles. They appreciated the urgent need of the city for water for domestic and municipal purposes, but they resented the application of Owens River water to distant San Fernando Valley lands in view of the fact that the latter valley was a recent annexation to Los Angeles.

In a desperate attempt to hold their own against economic strangulation, irrigators in the Bishop area organized in 1922 the Owens Valley Irrigation District "not so much for the purpose of providing a medium for the irrigation

FIGURE 12.—Fully equipped dairy farm one mile north of Bishop, now abandoned.

of their land, but in order better to tie the water to the lands, and for the purpose of affording a central body which might more efficiently deal with the city of Los Angeles." The organization failed, its funds were misappropriated and now most of the lands involved are city-owned. The despoliation of the valley will appear all the more regrettable if it is subsequently proved that storage of water above Owens Valley would have provided water sufficient not only for the domestic needs of Los Angeles but for the maintenance of farming in Owens Valley as well.

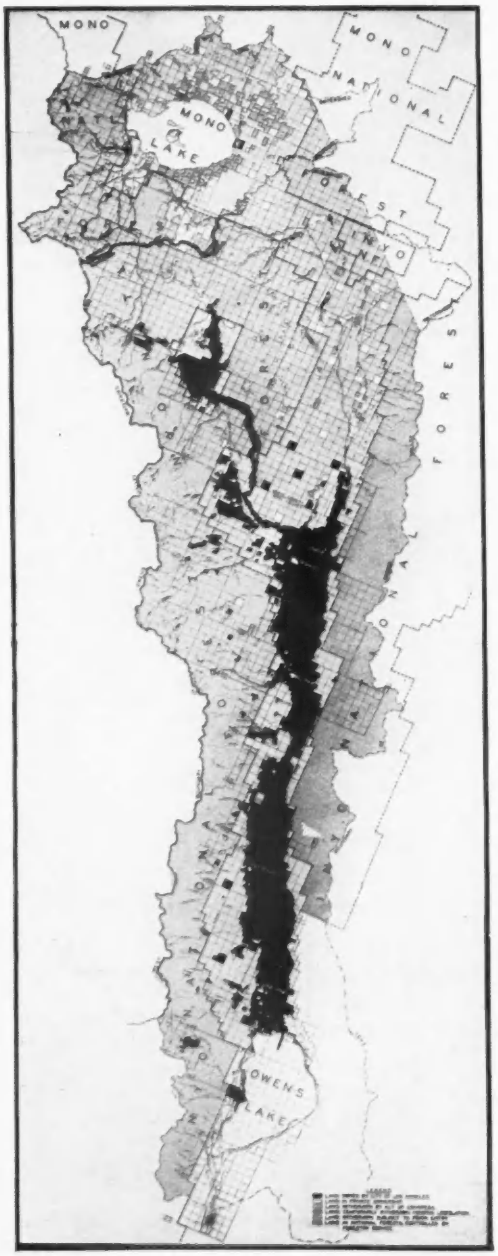


FIGURE 13.—Status of land ownership in Owens Valley and Mono Basin, June 1933. (Thirty-second Annual Report of the Board of Water and Power Commissioners, City of Los Angeles. Fiscal year ending June 30, 1933.)

MUNICIPAL OWNERSHIP

Private ownership of land has nearly disappeared in Owens Valley. In order to control unquestionably the water crop, local users have been eliminated one by one until today valley lands and towns are municipally owned. Figures 13 and 18 show the extent to which the land-purchase program had been carried by 1933. To date (July, 1936) nearly all individual owners have been frozen out. Recently ten city councilmen approved the buying of certain remaining lands in the Bishop district "in an effort to clean up the Owens Valley land-purchasing program." The purchased farm lands are allowed to revert to desert. Farm houses occasionally are leased, although no water is guaranteed occupants except for limited domestic use. The same policy applies to town dwellings. Unoccupied buildings are demolished or burned.

But municipal ownership has not been without certain advantages, particularly during the recent economic depression. The City of Los Angeles is the largest tax-payer of Inyo County. The city pays, according to an estimate of the Inyo County auditor, 80 to 85 per cent of that county's taxes.

PASSING OF AGRICULTURE

The destruction of agriculture in the Bishop-Laws area is almost complete. Figure 8A is an adaptation of a map made by the United States Reclamation

FIGURE 14.—The school house at Laws six miles east of Bishop. The enrolment of 37 pupils in 1923 gradually dwindled to 12 in 1933 when the district was consolidated with Bishop and the school building, now the property of the City of Los Angeles, was abandoned to marauders and the elements. April 1936.

Service in 1921 of the utilization of lands west of Bishop. At that time this area was one of the most highly cultivated in the entire valley. Figure 8B shows the present state of the same area, its cultivated lands pitiably shrunken.

Seventy-five per cent of the 7,564 acres of the West Bishop district formerly were cultivated, according to the county assessor. Today only 15 per cent is farmed; the remaining 85 per cent is city-owned. The owners of the few ranches still functioning in West Bishop neither wish, nor are they compelled, to sell their lands and water rights. Moreover, they are protected by the Chandler Decree, a judicial decision which apportions to riparian owners on Bishop Creek a specified amount of the normal flow of that stream.

The thriving condition of the four largest parcels of land still under cultivation (Figure 8B) is mute evidence of the productivity of the Bishop area prior to its abnormal desiccation. The appearance of these well-ordered ranches, oases in the midst of desolation, helps us to visualize the aspect of the cultural landscape of the whole district when it was at the peak of its agricultural development. These remaining ranches are still producing hay, corn, and forage. Sheep, dairy and beef cattle provide some surplus products which are marketed at nearby mines and mountain resorts. Two dairies are allowed to operate near Bishop, on properties leased from the city. Elsewhere, except for tiny gardens on the Indian Reservation, the 12,800-acre area embraced in Figure 8A has reverted to desert wherever it was formerly tilled. Abandoned houses, barns, silos, agricultural equipment, gaping cellar holes, and ruined stone foundations bespeak a once extensive rural activity and the residence here of a numerous population.

POPULATION DECREASE

The most pronounced loss of population during the decade 1920 to 1930 naturally occurred in the north end of the valley. The Federal Census reports a decrease of 6.8 per cent for the entire county of Inyo. But for townships 1 and 2 (Laws, Round Valley, Bishop) the decrease amounted to 20 per cent. Inasmuch as the exodus of people has continued unabated since 1930, the next decennial census will doubtless report a still greater decline.

The loss in population is even more apparent in the drop in school enrol-

FIGURE 15.—High peaks, deep canyons, rushing streams, and quiet lakes beckon summer vacationists in increasing numbers to camp grounds and resorts on the east slope of the Sierra Nevada. This camping site on Bishop Creek combines the elements of typical Sierran scenery. (Courtesy of Department of Water and Power, City of Los Angeles.)

ment. By 1936 six elementary schools were reported by the County Superintendent as lapsed, one suspended, whereas six had been consolidated with larger units, primarily because of declining attendance. Thus the number of elementary schools in Owens Valley proper has been reduced from twenty-one as listed in 1922–23 to only eight in 1936. From an average daily attendance of 15 pupils in 1923–24, the Pleasant Valley School gradually declined to the vanishing point in 1934–35 when the district was lapsed.

High schools, except for Lone Pine, likewise show greatly diminished attendance. The Big Pine High School experienced a 50 per cent decrease in enrolment between 1922 and 1935, while Bishop's decrease was 62 per cent.

ALTERED FUNCTION OF TOWNS

The alteration in function of a widespread tributary area necessarily has changed the function of the towns. With the destruction of agriculture one might expect a gradual dissolution of the market centers. Such probably would have occurred had the towns depended solely on the enveloping farm lands. It is true the towns of Owens Valley originated as local trading points, but they grew to serve a larger non-contiguous area than the agricultural lands on the valley floor. Mining has always been an important industry in the adjacent mountains and deserts, and recently it has entered upon a period of renewed activity, particularly the mining of gold, silver, tungsten, and lead and the recovery of salines.

But the significant element in today's economic life is the fact that the axis of the valley is the route of a major state thoroughfare. Since the improvement of the highway an increasing traffic is passing through Owens Valley. The opening of resorts on the east slope of the Sierra Nevada is bringing Bishop increased business.

A study of the traffic census at the Bishop-Laws intersection 1924 to 1935 inclusive, shows increasing use of the highway, a fact not entirely accounted for by the increasing number of cars in the State. On a selected Sunday in

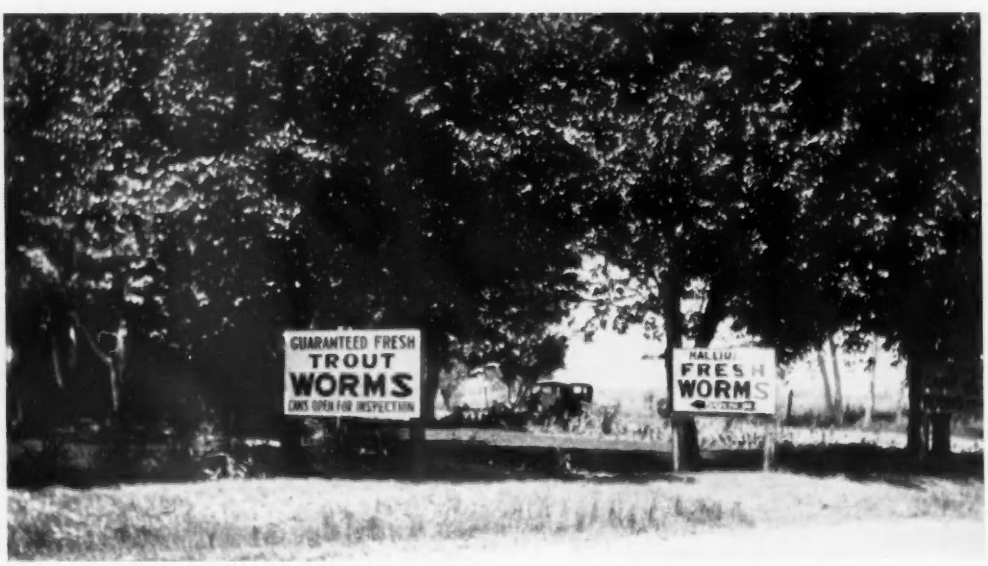


FIGURE 16.—Catering to passing motorists enroute to fishing centers in the nearby Sierra is becoming a profitable activity for residents along the state highway in Bishop.

FIGURE 17.—The destruction of its tributary farm lands is rapidly altering the function of Bishop, largest town of Owens Valley. Formerly a market center for the productive northern end of the valley and for mines within a hundred-mile radius, it is today profiting by its frontage upon the major thoroughfare of trans-Sierra California. (Courtesy of Department of Water and Power, City of Los Angeles.)

July, 1924, 509 cars passed the intersection. On a corresponding day in July, 1935, the number had more than doubled when 1,092 cars passed the point. Winter traffic not only is lighter but shows little variation from year to year. On a particular Sunday in January, 1925, 338 cars passed the Bishop-Laws intersection and on the following Monday 215; corresponding days in 1935 showed 322 for Sunday and 224 for the following Monday.

Bishop is the point of divergence of roads entering the recreation region. Just north of the town the road turns toward the west and within twenty miles leaves the desert valley to climb Sherwin grade. Beyond this point from Rock Creek to Lake Tahoe are found some of the State's finest camping and fishing places in settings of awe-inspiring grandeur. Large hotels cater to a fastidious clientele at the Mammoth Lakes and June Lake resorts. El Camino Sierra connects also with roads over the Sierra via Tioga, Sonora, Kit Carson, Echo Summit, and Emigrant (Donner) passes terminating in the San Joaquin-Sacramento valleys and on San Francisco Bay.

To help in serving the transient population eleven gasoline stations, five garages, four auto camps, one modern hotel, and a dozen or more cafés and other food dispensaries are distributed along the 1.2 miles of state highway upon which Bishop fronts. But the supplies purveyed to passing tourists are not valley products but are trucked in 300 miles from Los Angeles. Evidence that the town ever exported grain, hay, fruit, honey, stock, dairy, and poultry products is rapidly being obliterated. Creamery, apple-packing plant, grain and hay warehouses no longer function.

It is surprising that the decline in Bishop's population has not been greater. From 1,304 persons in 1920, the town dropped to 1,159 in 1930. The estimated population in 1935 was 850. Families of employees of the Department of Water and Power (City of Los Angeles) and of the California State Highway Commission have helped somewhat to maintain the number of the town's permanent residents. In Bishop also is the district office of the U. S. Forest Service and the agency of the U. S. Indian Service for the southern trans-Sierra counties, Mono and Inyo.

It is interesting to observe that the fate of the five valley towns has not been identical. The dissolution of Laws and Big Pine as communities is almost complete. Like Bishop they served local farming districts which are no longer under cultivation. Big Pine, only fifteen miles from Bishop, has scant economic basis for continued existence except that the road to Goldfield diverges here to cross the Inyo Mountains via Westgard Pass (7,276 feet). At Laws, the station on the narrow gauge railroad nearest Bishop, the major oil companies maintain gasoline storage tanks, sources of supply for northern Owens Valley and east-slope Sierra points.

The town of Independence, county seat of Inyo County, continues to be the residence of many county officials. Here, too, are the main offices of the Department of Water and Power. Deserted farmsteads are not conspicuous near Independence because agriculture was never so generally practised as in the Bishop-Laws area.

Lone Pine, at the southern entrance to the valley, has actually added to its population during recent years. Nearby mines and the saline recovery plants on Owens Lake have brought business to the town. Moreover, Lone Pine is benefiting from the greatly increased traffic using the improved road into Death Valley via Darwin and the Panamints.

NATURAL HANDICAPS OF OWENS VALLEY

It is doubtful whether Owens Valley ever could have competed successfully with other agricultural areas tributary to the markets of metropolitan Los Angeles. Other things being equal, the distance would have been prohibitive. Compare, for example, the 220-mile haul to Los Angeles of Imperial Valley's varied products with the 280-mile distance from Bishop. The apples and pears of Victor Valley are distant only 100 miles from city markets, while Antelope Valley hay, whose excellent quality brings top prices, is only 80 miles from Los Angeles.

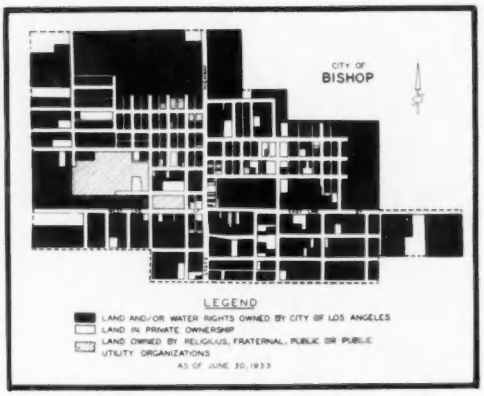

CITY OF
BISHOP
LEGEND
LAND AND/OR WATER RIGHTS OWNED BY CITY OF LOS ANGELES
LAND IN PRIVATE OWNERSHIP
LAND OWNED BY RELIGIOUS, FRATERNAL, PUBLIC OR PUBLIC UTILITY ORGANIZATIONS
AS OF JUNE 30, 1933

FIGURE 18.—Status of property in the city of Bishop, June 1933. (Thirty-second Annual Report of the Board of Water and Power Commissioners, City of Los Angeles. Fiscal year ending June 30, 1933.)

Moreover, northern Owens Valley has a shorter growing season than competitor valleys. The average frost-free season at Bishop (elevation 4,450 feet) is 152 days; in the Antelope Valley (Mojave) it is 265 days; while in the Imperial and Coachella valleys the length of the season is approximately 300 days (Brawley, 296 days; Indio, 302 days). Fruit growing was always precarious at Bishop even on the high sloping fans near the base of the Sierra. Only three cuttings of alfalfa on the average are obtained at Bishop, whereas five or even six are harvested at Lancaster in Antelope Valley.

Furthermore, future expansion of farmland in the Bishop area would have been limited by the character of the soil. Too large a per cent of the soils are of poor quality. A recent survey shows that only 12.1 per cent are of high agricultural value, while 37.7 per cent are of low value and 50.2 per cent are valueless for agriculture.

The characteristics of soil and climate unquestionably would have limited production in northern Owens Valley. On the other hand, the remoteness of the area would have encouraged an increasing production of the foods required by nearby mines and resorts. Owens Valley is particularly well adapted to grazing and dairying and the products of these industries would have continued to find a ready market in trans-Sierra California and western Nevada.

FUTURE OF THE AREA

In the light of the present increase in demand for fresh foods in a region of growing tourism, one conjectures whether limited farming to supply local needs will be revived. Land is now leased and water allowed dairies in each of the four valley towns. Water is also distributed to several pack-train organizations located at the canyon mouths of the Sierra. The outfitting of mountain expeditions is an important business in Owens Valley, and it gives promise of still further expansion.

Meanwhile, the buying of land and the acquisition of water and power rights by the City of Los Angeles proceeds apace. The tentacles of the city now reach beyond Owens Valley through Owens River Gorge into Long Valley, both of which are owned by Los Angeles. A great tunnel under construction will divert water from the Mono Lake drainage area into upper Owens River, thence into the Los Angeles Aqueduct. Looking forward to probable future needs of a more and more populous metropolitan area, the present is a period of spectacular expansion of water resources.

It is conceded by the Department of Water and Power that after the addition to the Owens River supply of the 135 second-feet (average safe yield) of water from Mono Basin, surplus water may exist in years of super-normal or even normal precipitation. Moreover, by 1940, the Colorado River Aqueduct will bring an additional 1,500 second-feet into the Los Angeles lowland for use of the thirteen cities of the Metropolitan Water District. A part of all

FIGURE 19.—Time and the torch are rapidly effacing all evidence of the sixty-year period of agricultural development in Owens Valley.

this water may in favorable years be utilized to recharge the depleted underground basins adjacent to Los Angeles as well as those in Owens Valley. In such a recharging process farming might well be allowed on municipally-owned lands, but water obviously could not be guaranteed farmers during years of subnormal rainfall. One can visualize, therefore, a possible return to productivity of limited areas in Owens Valley. But resuscitation would be conditioned by city water needs.

Already the problem has arisen of governing the extensive municipally-owned lands in the non-contiguous county of Inyo. The Department of Water and Power has charge of leasing city-owned houses and lands, of providing residents with water and power, and of sewage disposal. A movement is now on foot to disincorporate the one incorporated town in the county, Bishop. Los Angeles favors this plan as it believes that as a result its taxes in the community would be greatly reduced. The disincorporation of Bishop would bring the entire valley under the uniform governmental control of Inyo County.

Its normal course of development as an isolated farming area abruptly terminated by the diversion of its major resource, Owens Valley may yet fulfill a larger destiny which its geographical location as a transit region seems to insure it in selling services and supplies to the ever-increasing number of pleasure seekers Sierra-bound.

SHIFTING CULTIVATION

Derwent Whittlesey

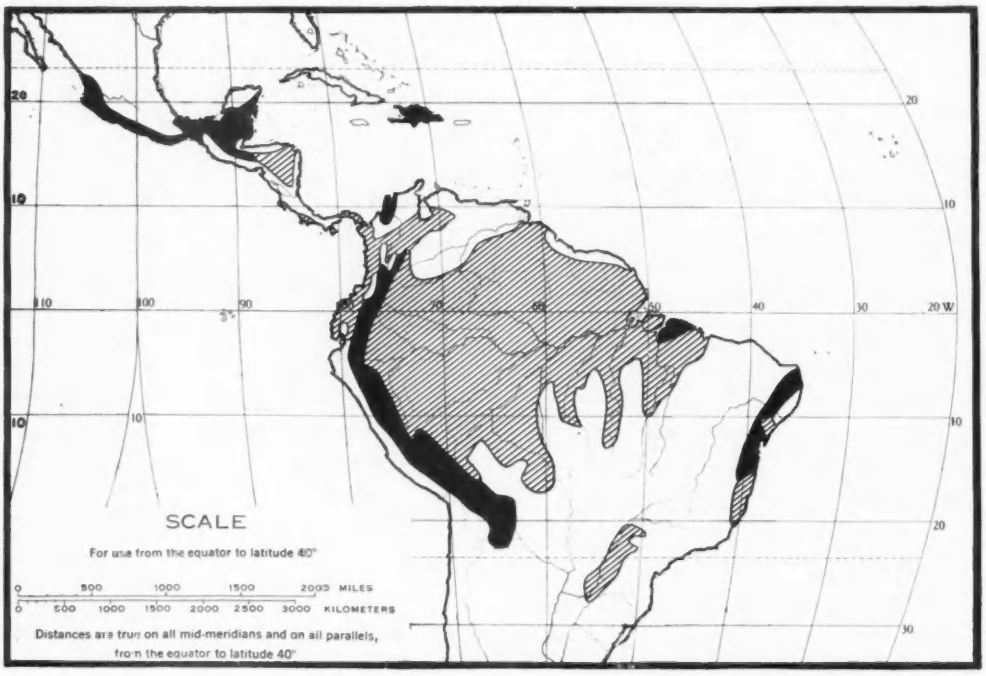
WHEN the conservation of our farmlands is discussed, some member of the company usually insists that "the tropics" can satisfy all future needs for crops. A few small districts within the tropics are at the moment producing more rubber, sugar, and coffee than can find a market. Aside from these carefully chosen "plantation crop" areas, the humid low latitudes yield very little farm produce for sale to the middle latitudes, and neither plantation nor native farm specializes in any *staple* food. Yet food has been raised in these regions from remotest antiquity by practices which persist today. Investigation of this widespread indigenous agriculture should give some notion of how much reliance can be placed on tropical farmlands if we allow our own to be destroyed.

The striking feature of the farmed landscape in the humid low altitudes is its ragged appearance. From the air, or from casual observation on the ground, most of the fields are indistinguishable from surrounding natural vegetation. Close inspection discloses that the tilled land is scattered in small patches through the forest or brush, that a number of trees are left standing amid the crops, and that several crop plants are growing up together. Between and around the fields, or more properly, the gardens, are pieces of pioneer woodland in several stages of growth, besides "high bush"—climax forest. To distinguish used land from idle is not always easy, since a group of people may be busily gathering seeds or fruits from trees which appear to be growing in a state of nature. If it happens to be the dry season, one sooner or later stumbles on half a dozen men energetically making bonfires of vines, grass, and twigs. They are finishing the job of clearing the ground in an opening which has recently been burned over, leaving upright and fallen trunks and a few live trees. In such clearings is found the clue to the pattern of the agricultural landscape which at first sight appears such a jumble—the tilled land is shifted at frequent intervals. This is not pioneering in the wilderness preparatory to making a permanent home. It is the perennial law of ordered existence.

Shifting cultivation (see Figures 1, 2, and 3) takes on its most characteristic forms in regions which have one or more seasons of copious rain, alternating with shorter periods when little or no rain falls. In such places relative humidity remains high throughout the dry season. In such a climate the natural vegetation is rain forest. Shifting cultivation extends beyond the limits of the rain forest across a marginal zone perhaps once covered with similar vegetation. Still farther from its centers it reaches into regions where a single season of copious rain is followed by a dry season which may last half the year, with relative humidity less than 10 per cent during the hot hours of the day. There the natural vegetation is brushy and grassy, with low trees spreading close above the plumes of coarse grasses. In this zone shifting cultivation gives way to nomadic herding or primitive livestock ranching. (See "Nomadic Herding Region," ECON. GEOG. 8 (1932), 378-85.)

THE FARMING CYCLE

Farming operations begin with the


SCALE
For use from the equator to latitude 40°
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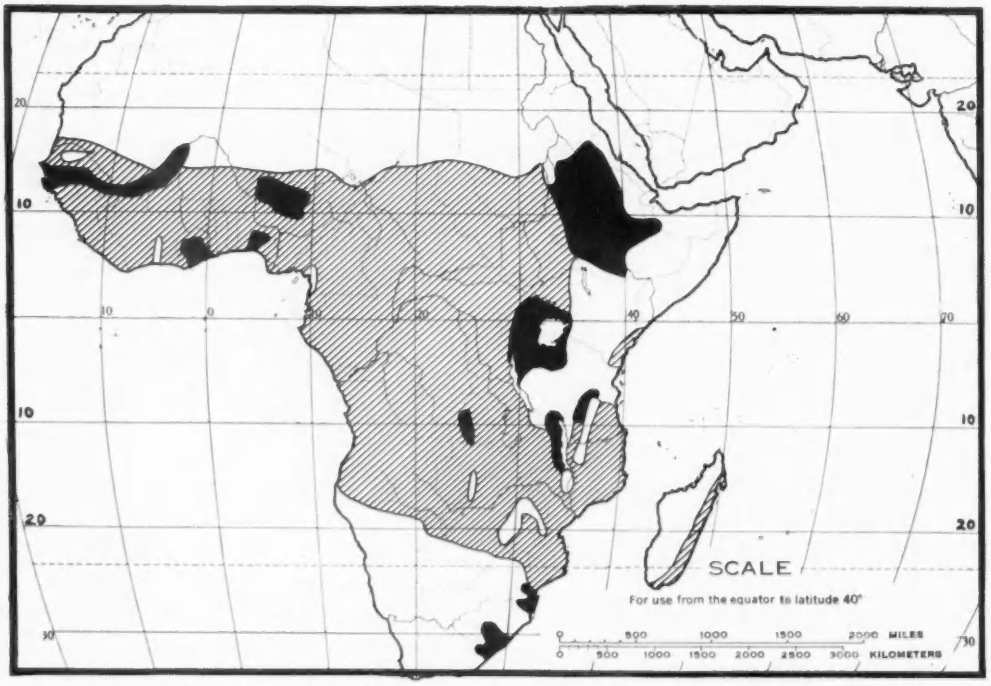

FIGURES 1 AND 2.—The regions of shifting cultivation and its modifications. The agriculture of many small districts shown as practising shifting cultivation is actually sedentary; these patches are too small to be shown on maps of this scale. Most of the South Sea Islands, although not shown, are devoted either to shifting cultivation or to rudimental sedentary tillage. (Goode Base Map 201 H. C. Reprinted by permission of the University of Chicago Press.)

selection of a piece of forest for clearing. The densest woods available are chosen, because absence of brushy undergrowth makes them easiest to clear with the primitive tools at command. Where the primeval forest has long stood on the ground, the humus content of the soil, never high in low latitudes, is at maximum. Toward the end of the rainy season the men of the village attack the forest with cutlasses. (The cutlass, or machete, is a heavy knife with a blade about three feet long and a handle of hardwood heavy enough to balance the weight of the metal.) They hack down lianas and saplings, and in most regions girdle larger trees, with the cutlass, or by setting fires around their boles. Sometimes large trees are felled, being cut above the buttresses, where the bole is comparatively small.

Near the end of the ensuing dry season, when the leaves have dried or fallen, the whole tangle of felled brush and desiccating trees is set afire (Figure 4). The little clearing left by the burn is only a few rods across (Figure 5). In the valley of the Madre de Dios, a Bolivian tributary of the Amazon, it is said to take a man 25 days to fell, burn, and prepare one hectare of forest land. Valuable trees such as oilpalms, edible fruit, or forest giants desired for shading crops from sunburn, can withstand the fires if they have been exempted from girdling. Trunks, stumps, and other unconsumed débris are left to be destroyed by decay and termites, a job which takes only a wet season or two. In the meantime they retard soil wash, which is active in these regions of heavy downpours, especially on slopes. Slopes, even steep ones, are often selected for clearings because their soil is relatively fertile, being perennially rejuvenated by creep and wash. A prized

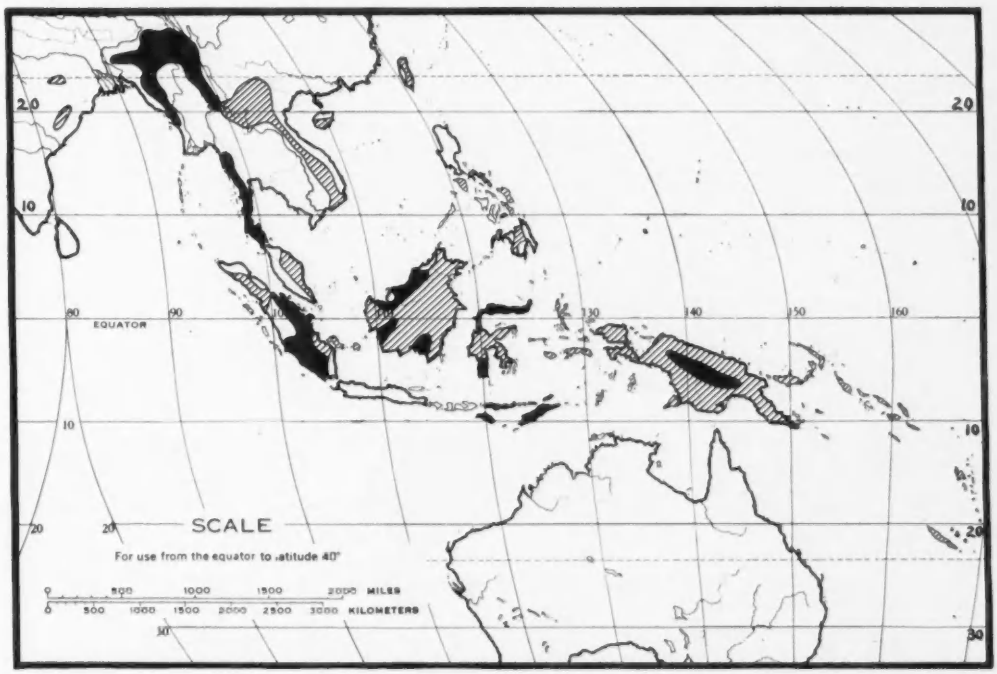

FIGURE 3.—The same phenomena of shifting cultivation are revealed in the Far East, where throughout Malaysia and its environs the same kind of change goes on as in the tropics of South America and Africa. (Goode Base Map 201 H. C. Reprinted by permission of the University of Chicago Press.)

FIGURE 4.—Burning brush in a new clearing in the rain forest. Southern Nigeria.

by-product of the burning is the accumulation of potash, which increases the fertility of the soil. At the same time the fire reduces the slender hoard of humus.

The planting is calculated so as to take maximum advantage of the rainy season and to bring the harvest at the next succeeding period of dry weather. In regions with much rain this is likely to be the "little dry season," of short showers at long intervals. Since the soft foods produced by these very wet climates can not be kept long in high temperatures, the period of the harvest is the time of gorging and rejoicing, the more so since the preceding weeks of nature's gestation is almost sure to have been a time of scarcity, perhaps of famine.

The days of plenty are soon followed by restrictions on food and the necessity to plant for the next wet season. Hardy trees have withstood the fire. The roots of others send up new shoots as soon as the rains begin. Generally the rejuvenated trees and other pioneer plants (weeds) are still young enough to be cut back with cutlasses or burned off, and the second crop can readily be planted. In very wet regions this planting, freed from competition with natural vegetation, may be larger than the first, but in most places there is a decrease in return, owing to rapid deterioration in soil fertility, to lack of animals to provide manure fertilizer, and to erosion, at least on slopes.

In the drier places no preliminary clearing is necessary, and fire is often allowed to burn over all the bush, these consisting of low trees, scattered or in clumps, and coarse grasses. During the weeks when burnings are made the air is thick with fine ash, and spicules of charred leaves of trees and blades of grass fall like gentle, intermittent snow. At night dull glowing spots and brighter lines of flame may be seen creeping cross-country. The fires often get out of hand and ravage land not needed for crops. Some tribes, recognizing this danger, clear a strip of its ground cover and branches, to serve as a firebreak around the plot proposed for burning. Each burning slows down the regrowth of trees and gives the advantage to grasses. Once grass is established it is easily burned at any time during the dry season, and often catches fire from lightning or accident. Fires may so encroach on woodland as to leave timber only on rocky hills, loose sand, and wet flood plains.

Through the practice of shifting the fields the wettest rain forest is dotted with patches of jungle, where old burns are slowly being rejuvenated by pioneer vegetation. The effect on open woodland of the drier country is more lasting.

FIGURE 5.—Small cleared patches on a slope of the northern Andes; smoke of a new burn may be seen at the left. South Central Colombia.

Park savanna tends to give way to scrubby, somewhat thorny bush, or to become treeless savanna. The transition zone, once covered with tall bush, is overmastered by grasses encroaching from drier climates.

Whether the original forest is replaced by pioneer jungle or by scrub thicket or by grass, it is equally beyond the reach of tillage for indigenes armed only with cutlass and hoe. Therefore they must find other forested land after a few crops, and begin operations anew. A field can rarely be used more than three years, sometimes only one.

MIGRATION

The first clearings occupy the lands immediately about the village, and subsequent farmlands must be found at ever increasing distances. The time consumed in walking to the fields and back cuts into the working day, and it is precious time, because daylight never lasts much more than twelve hours, and crop failure dogs the farmer who prolongs his planting or his harvest season. The abandoned fields cannot be reclaimed until several years have passed —eight or ten with favorable conditions, forty or fifty in many regions—and after a few seasons it becomes imperative to move the village to a new location.

To stave off migration the villagers seal the doors of their huts with mats and lianas and move to the fields during planting and harvest times when the crops need most attention. There they put up temporary shelters—flimsy structures to ward off the sun, rain being uncommon at these seasons. At the end of the harvest the whole family turns porter, even the tiny children toddling along with a proportional load of the staple crop. Several trips must be made, because each person consumes more than he can carry in a single load. It has been estimated that in the Maya country forty man-loads of maize are necessary to support a family for a year.

FIGURE 6.—A washing place at a convenient point on a stream. A village stands near by on each bank. The stream is a tributary of the Upper Niger.

FIGURE 7.—One of half a dozen clusters which make up a village near the southern face of the Plateau in Nigeria. The trees are shea butter, papaya, and other producers of crops. The period of occupance here is several years.

After a few seasons the stubborn jungle and the swiftly depleted soil defeat the efforts of the farmer, and migration is decided upon. A chosen group of the men goes out to select a new site for a village in the midst of the most ancient forest that can be found. There they build a few huts as a nucleus of settlement and commence to clear the surrounding ground. At a time agreed on, the rest of the tribe moves in, after a trek of some days, bringing such food as they can carry. Construction of the village is completed and all participate in the farming operations. The first months are likely to be hard, because few provisions can be brought from the old home, and the virgin forest of the low

FIGURE 8.—Path to a village. The kitchen garden at the right is fenced to keep out poultry and thieves, but the village stockade has been omitted. Gold Coast rain forest.

latitudes is niggardly of edibles. The search for high bush may have taken the village into border territory in dispute with another tribe. This was a frequent cause for war until European governments stepped in to keep the peace.

Migration, while basically determined by invading vegetation and soil depletion, may be caused by a number of other vicissitudes. Disease, particularly malaria or sleeping sickness, may cause the evacuation of whole regions. Elephants may break up a village, since no native group can maintain itself within the ranging radius of these beasts (some ten or twenty miles). The village itself may fall into such disrepair, and the bare, hardbeaten earth of the site may be so gullied after several years that a new location must be found. In districts where tribal warfare is prevalent, the wearing of tracks to the village gate may be deemed a source of danger sufficient to warrant removal. As the time for tax collection approaches, subject tribes, whether subordinate to native rulers or to European states, are wont to hide in the bush, taking all movable property. A frequent excuse for migration is some tabu, usually related to an economic motive, and ultimately to the deteriorating natural environment.

Shifting cultivation entails very thin-spread settlement, even in favorable localities. In the forested mountain country of Eastern Guatemala each Indian family requires from 100 to 200 acres of land; in Nigeria from five to nine times as much arable land exists as is used in any given year. The amount of land worked by a family in any one season varies with the land and the crop, but is generally between three and ten acres. In the Amazon Basin a million and a half persons occupy two million square miles.

The distribution of this scanty population is far from uniform. The most fertile lands are immature soils of slopes and fresh soils of recently deposited alluvium—natural levees and flood plains high enough to escape inundation in most years. Stable, mature soils on flat interstream areas are thoroughly leached, shot through with iron deposits, and underlain by hardpan more suitable for road macadam than fields. On the piedmont alluvial plain and adjacent slopes at the north end of Lake Nyasa there are between forty and sixty persons per square mile, while not far away the Middle Rufiji Basin is uninhabited.

Favorable soils are still more prized if they lie near easy routes of transportation. Where the forest is deep and lianas and swamps hamper movement through it, most villages lie conveniently near river banks and the shores of lake and lagoon. In drier country a surface water supply is usually sought. Roads and railroads constructed by European governments have partially realigned settlement in narrow belts along the routes.

THE FARM VILLAGE

The village differs in plan and in architectural detail from region to region, but its essentials are everywhere much alike.

The site chosen is near water. Wells are not dug by migrant farmers, so water for drinking and cooking must come from streams, pools, or lagoons. The same supply is much appreciated for bathing, ablutions being frequently repeated in these hot and sticky regions. Except for the few tribes which use leaves, leather, or bark for clothing, the wash tub is a handy spot in the same stream or lake (Figure 6). A waterway also facilitates movement through the forest. A terrace on the outside of a meander, a knoll bordering a lake or coastal lagoon, or even a sand dune, is an ideal place. (Sand is quickly drained after rains, and it discourages weeds and insects.) Failing the natural vantage of an eminence, sandy or not, the houses in very wet country may be reared on stilts. Flooded islands and flood plains attract settlement because annual renewal provides the most productive soil anywhere available.

Little clearings are hacked out of encompassing bush, and there the village is built. The main settlement has traditionally been a single street, bordered on each side by a string of one-room huts, joined by hedges or stockades of the same construction as the huts. Sometimes group houses as much as 200 feet long form the sides of the compound, designed to keep out

FIGURE 9.—The storehouses of a village in the Sudan, French West Africa. Part of the village community house may be seen at the extreme left.

straying animals or marauding human enemies. The village common thus formed serves as cookhouse, threshing and drying floor, dancing ground, and general meeting place. Facing it are tribal house and shrines of worship. Often a village consists of several small clusters of huts scattered through the original burn (Figure 7). Useful forest trees and home gardens lie conveniently between the clusters. European domination, by putting a stop to tribal warfare, has favored the scattered village. Where neither people nor beasts prey, the compound is left incomplete (Figure 8).

FIGURE 10.—A large clearing, with the forest behind. Southern Gold Coast.

The buildings are quickly made. A frame of bamboo, palm ribs, or other light and strong wood is cunningly thatched and sided with palm leaves or grass. Sometimes the sides are daubed with mud. The materials vary with the local resources. Two houseforms, the conical "beehive" and the hip-roof rectangle, are virtually universal. Mats serve to close the sole opening at night, when the plague of mosquitoes is at its worst, and when the bearers of malaria are abroad. A smoky fire within the closed hut further discourages insects, and helps to warm the lightly clad inmates, who feel acutely the nocturnal drop of ten or twenty degrees of temperature.

Villages vary in size with tribal custom and available food supply. In the Amazon Basin single or small groups of huts may occupy individual clearings. At the opposite extreme are settlements of five or ten thousand on the margins of the savanna in the Cameroons. The number of houses rarely exceeds one hundred and fifty. The denser the forest, the smaller the settlements. The total value of the village is slight, consisting solely of the few houses and some storage places, generally basketwork granaries erected on platforms to keep the food supply out of reach of rats and, in wet places, off the damp ground (Figure 9). The whole village is sometimes burned to destroy the accumulated vermin, and then rebuilt in the same place.

Equipment is confined to bare necessities. The larder, if well stocked, includes piles of tubers, a store of cereals, grated manioc drying in the hot sun, a little dried fish or jerked game, some kind of oil or grease, and the local alcoholic beverage.

THE FARM

During the first year after settlement the farmland closely surrounds the village, but subsequently the planting retreats, and is reached by paths maintained by constant walking through the forest or the head-high grass. On entering a forest path the sunshine dims to twilight almost at once, and on approaching the next clearing it appears as a bright spot of light at the end of the tunnel. In the drier regions the paths are ruts in the tall grass, walled by sharp-edged leaves.

The cleared patches vary in size. Individual farms run from one to four acres in Nigeria, one acre being the average in the hills, and two on less fertile lowland soils. As a rule several heads of families make their plantings

in common, and in some regions the combined clearings of a village occupy considerable expanses (Figure 10).

The farm is, strictly speaking, a garden. The annual and biennial crops, including plantains, are planted by hand or sown broadcast among the stumps, the firefalls, and the scattered trees—palms, various fruits and nuts, perhaps coffee or cacao—left standing in the clearing for the sake of their fruit (Figure 11).

In the moister regions tuberous root crops rank as the leading staples. Of these manioc is the general favorite, but in places yams or taros hold first place. In small districts one or another of these may be relied on to the exclusion of the rest. The tubers are planted among grains, vegetables, and plantains, except by the most advanced groups, who have learned to confine crop combinations to the several members of the tuberous families. In the dryer regions manioc holds a place, but on dry soil the leading staple is likely to be a grain, in America maize, in Malaya (including Madagascar) dryland rice, in Africa sorghums and millets. One of these is rarely found alone. Maize is a common companion of dryland rice, because it matures six weeks or two months earlier and so tides the people over the scarce days preceding the rice harvest. The grain sorghums serve similarly as appetizers for the maize harvest in regions too dry for rice. Two crops of maize may be planted at intervals in the same field, in order to prolong the harvest season. In places where the rainy season is divided into two parts by a period dry enough to ripen crops, some of the jungle is left to be cut back at about the middle of the long dry season, and the land is planted to peanuts, cucumbers, tomatoes, pimientoes, and other quick-growing plants. These spring up during the early rains and ripen in the "little dry season." In addition to these varied annuals, the plantain is an important member of every crop association where rain suffices, because it yields all year, although less generously during dry weather. Beans, peas, peanuts, and other legumes sometimes figure in the

FIGURE 11.—A characteristic farm, on the slopes of a ravine. In the foreground manioc and other tubers are growing amid plantains, cacao, forest fruits, and palms. On the far slope an open patch is devoted to yams, and the pioneer jungle lies beyond, including a high proportion of palms, due to selective deforestation. Gold Coast.

crop combinations. Besides these field crops miscellaneous garden plants are grown on small patches near the village —kitchen gardens maintained in cultivation on the rapidly deteriorating soil only with great effort (Figure 12).

Nearly all the staples are propagated exclusively by stock, no seed being known to the indigenous farmers; some of the tree crops have no contemporaries in the wild state, but have been husbanded to our time from a botanical era otherwise extinct. These facts disclose the immeasurable antiquity of shifting cultivation. When the farm is remote from the village, it is devoted to the food staples. Often annuals, such as yams, taros, sweet potatoes, and cereals, are interspersed among biennials or perennials—manioc, cotton, plantains, sugar cane—which yield little or nothing the first year, and have the ground to themselves the second.

FIGURE 12.—Men working on garden land maintained in cultivation year after year. Not far from Bamako; the Upper Niger River traverses the scene in the distance.

THE CROP YEAR

Men, women, and all but the youngest children work on the farm at planting time. As soon as the ashes are cold the women sow the seed or insert the cuttings. The work is nearly always done in concert, and coöperatively. Among the most primitive a sharpened stick is used to stir the ash-covered soil or to make holes for the cuttings or seeds, or a wedge-shaped stake serves as plow, hoe, and rake. If the ground is very hard (lateritic) the men may break it up with wooden clubs, but this is considered unnecessary if a good burn has been effected. It is a mistake to suppose that most migrant farmers use only such crude tools. Many tribes have developed implements of the mattock or spade family, made out of iron which they find in their lateritic soil. Generally nowadays iron or steel implements are purchased from manufacturers in Europe or America. Sometimes local smiths shape discarded shovels, picks, and other white men's junk into implements similar to those traditionally used by the tribe. Planting often entails piling well-pulverized soil into ridges or into broad banks four or five feet square and a foot above the bordering trenches (Figure 13). However careful the operation, it is always performed by hand.

Until the seed has germinated boys are kept busy all day driving away birds. They may use slings, or rattles made by lines of gourds slung between trees, or

scarecrows. In blinds built in the fields watchers remain on duty day and night. Rats and locusts are the most feared pests because they can neither be barred out nor frightened away.

Between planting and harvest the farm may receive no attention. In most places, however, trips are made to the plantation once or twice during the growing season, to pull, cut, or hoe weeds and brush. Tripods must be erected for yams to climb on. Cotton seems to be the most particular of all the crops grown, and is hoed two or three times a year (at least in the Amazon basin).

During the ripening season watch is once more set in the fields to scare off birds and small animals. Most big beasts can be fenced out with palings of thorn bush. At harvest time human poachers are also a menace. The root crops may be left in the field until needed. Since a yam or a manioc root may weigh 40 or 50 pounds, one keeps a family going for several meals. Grain may be stored temporarily in grass bins in the field, but as soon as possible it is carried to the village and placed in the storehouses there. Pits are used for storage only in the driest sections. Threshing may be done all at once in the field, or as needed in the village. The grain is beaten free from the straw with canestalks or pounded in mortars (Figure 14) and it is winnowed by being poured from one gourd to another on a breezy day. Maize is often tied into huge bunches by the husks and hung out to dry (Figure 15). Manioc must be washed to remove its poisonous ingredient.

FIGURE 13.—Patches prepared for yams or other tubers by heaping the soil into mounds. The dissected southern margin of the Nigerian Plateau.

FIGURE 14.—Women threshing sorghum. A mortar and winnowing gourds stand at the right. The structures are granaries, completed and under construction. Cape Verde, French West Africa.

The distribution of labor among the family is calculated so as to be as fair as possible. The children are given light loads to carry and errands to run as soon as they can toddle, and the very old do such odd jobs as their strength permits. The able-bodied men and women share the field work, but since the women have to do the cooking, nursing, and other household tasks, the men perform a good deal of the field work, in some districts as much as four-fifths. When fighting was constantly to be feared, the men used to escape much of the field labor by going on military expeditions, and they still like nothing better than to shoulder a bow or a gun while the women carry everything else on the trips between farm and village.

Nowadays, with peace enforced by European governments, the men have little excuse to shirk farm work. The division of labor varies, generally according to tribal custom, which itself may be based upon some circumstance of

present or past environment. Generally women take care of the home garden, and work in the remoter fields in such time as is left. Among some tribes certain crops are tended by the women, others by the men. The women may work in the fields a fixed part of the day. A suitor often has to work on the farm of his prospective father-in-law, sometimes as many as six seasons, sometimes only two or three.

Niggardly environment and inefficient implements explain the paradox of extensive and crude agriculture carried on with unflagging industry and the outlay of much physical energy. It is a misconception to suppose that primitive cultivators rarely work, and spend most of their time lolling about. Between primitive tools, inferior seed, ravages of animals, birds, and insects, and often repeated clearings of forest, the farm absorbs the combined energy of the whole family. While at work, it is the rule to work hard. Perhaps the universal custom in these regions of observing a siesta at midday has given rise to the misapprehension; whereas this is merely a common sense adaptation to an environment in which heat and rain join forces to make work in the fields impracticable during the early afternoon. Certain groups may be listless because they are physically below par. Malaria is epidemic everywhere, sleeping sickness has ravaged many tribes of central Africa, and the universal practice of going barefoot spreads hookworm.

FIGURE 15.—Ears of corn hung up to dry in a village of the Ivory Coast province of French West Africa.

FIGURE 16.—Poultry in the dooryard at the edge of a clearing in the Nigerian rain forest. Telltale evidences of contact with Europeans are the gasoline tin and the tarpaulin of drying cacao beans.

DOMESTIC ANIMALS

Animals are not really *kept* by the migratory farmer, but such as can maintain themselves are allowed to attach themselves to the family. Scrawny chickens, ducks, half-wild guinea fowl, or some other poultry is universal (Figure 16). They scratch about the village and in the cutover, and they roost in the hut. The eggs furnish a much needed protein element to the diet, and the meat is occasionally eaten as a rare (though tough) delicacy. Meat spoils so quickly in the humid heat that it must be eaten on the very day it is killed; hence it is tough. Many tribes which have animals are vegetarians. Next to poultry, pigs are most common, a long-legged razorback type, which can't find enough

forest mast and village garbage to become fat, and which probably would remain thin on any feed. They serve as scavengers and they provide occasional meat dishes. Most villages boast a few goats kept for their skins. They give little milk, less hair, and their meat is tough. In drier sections there may be sheep of the hairy variety, serving much as do the goats.

Some of the more advanced tribes maintain swarms of bees in hives made of baskets and lodged among the branches of trees (Figure 17), but more often honey and wax are collected from the forest. The inevitable half-starved dogs hang about the villages, licking their sores or sleeping. They may engage in hunting, and they may be served up as a last resort in time of famine, but they are primarily pets.

The large domestic animals are less common. Asses, small-humped cattle, and carabaos are used for pack or draft, but only locally where Europeans, Arabs, or Malays have introduced them. In the African rain forest, and in much of the drier bush as well, large stock is ruled out by the tsetse fly. Human porters are more commonly the beasts of burdens than animals in all regions of shifting cultivation. The paucity of stock conduces to frequent shifting of fields, because manure for fertilizer is lacking.

FIGURE 17.—A basket hive half a mile from a village in the French Sudan. The opening of the hive faces southwest; the strongest winds blow from the northeast.

FIGURE 18.—Nomad cattle grazing on an old field. The dry season is about a month advanced.

On dry margins of shifting cultivation, and even in wet districts where the tsetse fly is absent, cattle may be kept for hides and meat, and horses (as well as asses) for pack. In these places grazing amounts to more than casual sufferance of animals. In the Old World small groups of nomads live commensally with the tribes which till the soil. They house themselves in tents and graze their humped, longhorned cattle both on the natural grasses and on stubble fields (Figure 18). In the New World strains of cattle able to withstand the rigors of coarse fodder and pestilence have been introduced. There a primitive and small-scale livestock ranching business is carried on.

The coarse upland grasses of these regions are suitable for grazing only while they are young and green. As the dry season advances they lose their value

for fodder. It is said that cattle will die of malnutrition more quickly on this diet than on no feed at all. In the dry season the animals are folded on the harvested fields, where they pick up a living from what appears at a little distance to be bare ground. Peanut vines, plantain leaves, and other by-products of tillage are sometimes fed. Or stock may be driven to deltas, flood plains, and tidal flats, where nutritious grasses grow and remain green all year. In lowland Ecuador and in the Amazon Basin the cattle can be kept on the marsh grasslands nine months of the year; for the remaining three months they are flooded out, and must subsist on the upland pastures, where the rains of that season have sent up new shoots.

To clear out the dead grass for the sake of livestock much country never intended for tillage is burned over each dry season. It is a vexed question whether reiterated burning transforms the tree-dotted savannas into grasslands devoid of trees, or whether climatic desiccation is responsible for the indisputable disappearance of trees in many dry regions. Quite possibly the two forces work in conjunction. In hilly regions intensive grazing speeds up erosion, but on lowlands the stock may have the unexpected effect of giving the forest a fresh start, partly because the animals keep down the choking grass and partly because they scatter undigested seeds of pioneer trees which they have eaten.

Whatever the status of the livestock industry among migratory farmers, breeding is uncontrolled, and the breeds are notoriously small, scrawny, and unproductive, considering the amount of feed they consume. They are never housed, except that they may take refuge within the hut, or underneath it if it happens to be on a platform.

COLLECTING

Although tillage is the mainstay of shifting cultivation, it is always intimately associated with collecting from the forest and adjacent grasslands, including marshes and old fields. From the forests come edible fruits, oil-bearing nuts, gums, stimulants, fibers for clothing, dyes, wax, honey, leaves for thatching, poles for house frames, and fuel. The grasses yield thatching. Old fields, whether jungle or grass, bear ratooning perennials and stray self-

FIGURE 19.—Lightly smoked fish being packed for shipment up-country. The scene is the central plaza of a coastal village on the Gold Coast.

FIGURE 20.—Grain, sorghum, and squash in a fishing village of Cape Verde. The sea and surf in the distance.

seeded annuals. (Ratoon is a perennial crop in any year after its first harvest.)

The collecting of such products for home consumption is desultory, being fitted in to the time available, the season of ripening, distance from the village, and other exigencies.

HUNTING

Both forest and grassland provide hunting grounds, and game is a small but critical addition to the diet of migratory farmers, especially in the more open bush. Some tribes include families devoted exclusively to hunting, but more commonly the whole male population turns out from time to time in hunting battues. Toward the end of the dry season the fires needed to rid the ground of dry vegetation are set so as to drive the animals into corrals or pitfalls, where the men dispatch them. In denser forest a dozen men, with two or three women to cook and to smoke the game, go into the forest for ten or twenty days, that is until the provisions brought from the village are consumed. A rude shelter of branches is often erected for this period. Flood season is often chosen for these expeditions, so that temporary streams and bayous may be utilized as barriers and as *culs de sac* into which animals can be driven. Sometimes palisades supplement the water lines. In the deep forest animals are uncommon, except for monkeys, but tapirs, agoutis, and the dangerous wild hogs are taken. Birds are more numerous, but the commonest groups, such as parrots, are so tough as to be used mainly for soup meat. Whenever a man has spare time he is likely to try for game in the immediate vicinity of the fields. Even on the daily walk to outlying fields he is likely to carry a weapon. "I might see a piece of meat," he will say. And when a new village is being founded, game and fish alone sometimes avert starvation. Arrows, spears, pits, and nooses are used, and nowadays firearms, usually flintlocks.

FISHING

Fishing is somewhat more likely than hunting to be the special business of a tribe or a family, which may live on the coast (Figure 19), on mounds in flood plains, or, at low water, in temporary grass huts on islands which are flooded part of the year. Most such tribes grow staple crops to supplement their fish food (Figure 20). In addition to these specialized fishing families, some members of every village situated on or near water engage in fishing part of the time,

because the water provides more animal food than does the forest. Periodical fish drives are indulged in by whole villages, which move, for this event, to some suitable coastal lagoon, bayou, pool, or lake. A dozen camps may be made on the shores of a pond having no more than one square mile of surface, and even before Europeans began to enforce peace, a truce with all enemies was declared for the place and the time being. The men, armed with nets, converge on a designated point, thus chasing the fishes into their snares or onto the shore. During the first days there is an orgy of fish-eating, after which the surplus is smoked and dried for use in periods of food scarcity. Since still waters make the best fishing grounds, the fish drives usually take place either at the close of flood season, when the backwaters are full, or at the height of the dry season, when the fish life is concentrated in pools and the lagoons are shrunken. In mountain regions streams are sometimes dammed to obtain slack water. On coasts fishing in quiet seas is common, the daily trip to the grounds being undertaken in small boats, paddled or sailed. Even formidable surf does not deter these expert canoemen, although they may prefer the calm waters of deltaic distributaries and landlocked lagoons (Figure 21). Besides nets, fishermen use weirs, traps, line and hook, spears, and mild poisons which stun without damaging the fish. Turtles, frogs, and snakes are considered delicacies, and comprise a fair share of the fish take. In addition to game and fish, various insects and larvae are eaten. Paucity of food compels the full utilization of every resource, and these creatures are especially esteemed.

As a rule each village has its hunting preserve, and its fishing rights to certain bodies of water, on which others do not poach. Nevertheless, disputes over these rights are fruitful causes of warfare. This is particularly true when the prey migrates in search of food, and thus entices human pursuit to points beyond the recognized bounds.

FIGURE 21.—Dugout fishing canoes, Ivory Coast.

RETURN AND DISPOSAL

No systematic effort is made to improve plant stock, and the return is low. Famine often follows an unfavorable season, and only the luxuriant outturn of the starchy staples averts shortage in average years. It has been estimated that the average yield of starch per acre is between two and three times as much as in the middle latitudes, and this is borne out by comparable cane sugar production in regions of plantation agri-

culture, where all human and botanical factors are practically identical.

Stock is allowed to breed without attention, and natural selection has produced races relatively immune from diseases but scrawny and poor producers. It scarcely pays to kill for meat, and cows give little or no milk beyond that needed by their calves. Hides and skins are perforated by tick burrows.

Practically all the product, whether of collecting, of hunting and fishing, of farm and garden, or of livestock, is used for home consumption. There is always a little exchange among tribes, limited in the main to neighboring villages which can tap special resources. Thus, dried fish may be traded between sea- or lake-shore tribes and interior tribes, or rice grown on rainy hills may be exchanged for sorghum grown on lowlands in their rain shadow.

RELATIVE IMPORTANCE OF AGRICULTURE

In the nature of migratory agriculture no reliable quantitative data on outturn exist. Some notion of the relative importance of the various economic aspects of life can be inferred from the census taken in Southern Nigeria in 1921. It must be borne in mind that only in regions considerably modified by European occupation can such a census be taken, and that therefore the picture it gives is not that of untouched indigines.

Occupation	*% of Males*	*% of Females*
Farmers, hunters, collectors	73.5	76.7
Fishermen	2.3	....
Craftsmen of native arts	4.3	8.1
Traders	8.6	15.2
In European service	11.3	....
	100.0	100.0

Talbot, P. A.: *The Peoples of Southern Nigeria*, v. 4, 160–9 (App. X). London: Oxford Univ. Press, 1926.

A detailed map of the land occupance in a region of primitive cultivation would show tiny patches, widely scattered through the rain forest and beyond its margins in places, but mostly ranged along streams, or on the shores of lakes and seas. More numerous brushy spots would indicate tillage in the recent past, now being reclaimed by nature's pioneer vegetation. Between and behind these patches stands the unbroken hinterland of forest. The small amount of land utilized does not indicate incomplete occupance; rather it expresses equilibrium between the peculiar natural environment and inhabitants whose technology is native to the environment.

In places local conditions have forced migrants to modify their practices, and their agriculture has become sedentary in a rudimentary sense. Wherever Europeans and other outsiders have come into the area the equilibrium has been upset, profoundly altering economic life. These aspects of tropical agriculture are to be discussed in a subsequent article.

APPENDIX

PRINCIPAL STAPLE CROPS OF SHIFTING CULTIVATION

The names are those used most commonly. Many of these plants have as many local names as there are regions which grow them. Often the same name is applied to wholly different crops. The generic botanical names of the leading species are appended for the sake of more exact definition.

Group 1: Plants producing starch foods from tubers.
- Manioc (*Manihot*). Also called cassava. From it tapioca is made for export.
- Yam (*Dioscorea*). Not to be confused with "yams" of the United States South.
- Taro (*Colocasia*). Also called Dasheen, *i.e.* de Chine.
- Sweet Potato (*Convolvolus*). Includes the "yam" of the United States.

Group 2: Plants producing starch foods from fruits or stems.
- Plantain (*Musa*). Includes bananas.
- Breadfruit (*Artocarpus*).
- Sago Palm (*Metroxylon*).

Group 3: Cereal plants.
- Upland Rice (*Oryza*).
- Maize (*Zea mays*).
- Sorghum (*Holcus, Sorghum*).
- Millet (*Panicum, Eleusine, Pennisetum*).

Group 4: Leguminous food plants.
  Beans and peas (*Pisum, Dolichos, Cajanus, Phaseolus, et al.*).
  Peanuts (*Arachis*).

Group 5: Plants producing oils.
  Oil palm (*Elaeis*).
  Cocopalm (*Cocos*).
  Shea butter (*Butyrospermum*).
  Castor bean (*Ricinus*).
  Peanut (*Arachis*).
  Sesame (*Sesamum*).

Group 6: Plants producing sugar.
  Sugar cane (*Saccharum*).
  Sago Palm (*Metroxylon*).

Other groups—fruits, stimulants, fibers, gourds (for utensils)—should be added to make a complete list of crop plants, but they comprise an even wider range than the staples, and would unduly lengthen the table.

This article originated in the work of the author in collaboration with Wellington D. Jones on Types of Agricultural Regions. Its outlines have been traced in the *Syllabus for Geography 102* at the University of Chicago, by Professor Jones, with map by the two authors. (Mimeographed volume, issued by the University of Chicago Bookstore, 1932.) For the present study, including the revised map, the author assumes complete responsibility. The photographs were taken by the author.

STRUCTURE OF ELBE RIVER TRAFFIC

Monica H. Kusch

THE Elbe River is the chief commercial waterway of central and east Germany (Figure 1). With Hamburg as the eccentric focus, the Elbe and its tributary rivers and canals reach southward into land-locked Czechoslovakia, southeastward into Silesia, and eastward even beyond the German boundary into Poland (Figure 2). Thus, the Elbe River has attained second rank in the commercial utilization of German inland waterways.

That rank as second river in the amount of tonnage carried can be related to a number of very significant facts. The Elbe River flows through land-locked Czechoslovakia and the central German industrial regions, including Berlin. To compete with the industrial regions more favorably located with reference to the world trade routes both Czechoslovakia and central Germany make the best use possible of the cheap waterway furnished by the Elbe River, and consequently, it serves as an outlet for surplus foodstuffs, raw materials, and manufactured products in those areas, and as an inlet for raw materials, foodstuffs, and finished products.

The Elbe River would probably reach an even greater commercial significance but for some natural factors which react adversely upon the volume and nature of Elbe traffic. The river is subject to frequent and violent fluctuations in the level of the water, often limiting the passage of even partly loaded vessels due to low water. On that account much traffic is diverted and since the industrial system requires the scheduled movement of commodities as far as practicable, frequent diversions because of low water are decided handicaps. The bed of the river in Saxony is rocky and the channel gorge-like, while the lower course of the river traverses a low sandy plain which causes considerable difficulty due to the filling up of the dredged channel. These natural conditions are but a few of the main adverse conditions.

Elbe River traffic is characterized by the movement of very many commodities in small quantities. No single commodity has, in the past years, made up a large percentage of the total, for the hinterland of the Elbe is neither highly manufactural, nor intensely agricultural, but is a mixed region of mining, manufacturing, farming, and lumbering.

Traffic Divisions

The Elbe can be divided into three major traffic divisions, the lower, the middle, and the upper Elbe River traffic divisions (Figure 3).

The lower Elbe River traffic division extends from Hamburg to Lauenburg, a distance of 51 kilometers, and includes river traffic coming through the Elbe-Trave Canal. The average yearly tonnage of this division is 8,800,000 tons.

The middle Elbe River traffic division extends from Lauenburg upstream to Wallwitzhafen, a distance of 309 kilometers, and includes the navigable parts of the Havel, Saale, and the rivers and canals eastward to and beyond Berlin. This division has an average tonnage three-fourths as great as that of the lower division, namely 6,700,000 tons.

The upper Elbe traffic division, extending from Wallwitzhafen to the heads of navigation on the Elbe and Moldau rivers, a distance of 365 kilometers, comprises two sections, the Ger-

man upper Elbe division extending from Wallwitzhafen to the Czechoslovakian border, and the Czechoslovakian upper Elbe division extending from the Czechoslovakian frontier to the aforementioned heads of navigation. This division has an average tonnage of 1,900,000 tons, the German division contributing 850,000 tons and the Czechoslovakian division 1,050,000 tons.

The land adjacent to the traffic divisions, which makes up the hinterland of that river, may roughly be divided into primary and secondary parts. The primary hinterland of the Elbe drains one-third the surface area of Germany. It can roughly be described as that land within short-haul distance east and west of the river from the sea to Melnik, the Saale to Halle, the Havel including the Ihle-Plauer Canal and Berlin, and the Elbe-Trave Canal to Lübeck. In spite of the fact that the Elbe has numerous tributaries it has but few which contribute any traffic to the main stream. With the exception of the Moldau, Saale, and Havel, the tributary rivers are used only for a small and local trade. There is a secondary hinterland which reaches chiefly eastward beyond the Oder River into southeastern Germany, Poland, and Pomerania (Figure 2). The commodities from that area pass over various parts of the Elbe River on their way to Hamburg.

The Elbe as an important highway of commerce for the central and east German and Czechoslovakian industrial regions, constitutes the basis for this study. Its position as an important commercial waterway is reflected in the great need of the abovementioned regions for cheap transportation in a competitive industrial world. The present study will attempt to analyze the divisional traffic of the Elbe River in terms of the adjustment made in order to utilize natural and economic advantages and overcome physical disadvantages.

THE LOWER ELBE RIVER TRAFFIC DIVISION

The lower Elbe River traffic division is the focal point for nearly all of the downstream traffic of the Elbe River for several reasons. It includes the largest seaport of continental Europe, Hamburg. Quite naturally, most commodities in the hinterland of the Elbe which are destined for the world market move downstream towards Hamburg. Since the industries of the hinterland are so varied it follows that many of the surplus foodstuffs, raw materials, and finished products must seek outside markets.

Due to the great variety of commodities which constitute the traffic stream it is convenient to analyze the traffic by dividing it into major commodity classes. The commodity classes in the order of their importance on this division of the river are raw materials, food products, manufactures, and fertilizers.

Raw materials rank first in the movement of commodities on the lower Elbe River and make up approximately one-third of the total. The largest quantity of raw materials going upstream from the lower Elbe leaves the river at the mouth of the Havel where it is diverted in the direction of Berlin. A large tonnage of raw materials in the upstream traffic also leaves the Elbe at the manufacturing region of which Magdeburg is the center. The remaining raw materials of the upstream traffic leave in approximately equal quantities at the ports of the upper Elbe.

The downstream movement of raw materials consists almost wholly of commodities which entered the traffic stream along the middle and upper Elbe (Figure 4). Coal, lignite and bituminous, constitutes the leading commodity of the

raw materials class. The movement of coal is important in both the upstream and the downstream traffic. It is bituminous coal which enters the upstream commodity movement, while it is low-grade coal or lignite which enters the downstream movement on the lower Elbe.

Since the Elbe River flows through the central German manufacturing region which has little fuel except lignite, bituminous coal must be imported. Because of the bulky nature of coal much of it is moved by way of the Elbe River. The lignite which reaches the lower Elbe seaports in the downstream traffic is mined in the coal fields near Chemnitz and in Czechoslovakia. The amount of lignite reaching those seaports was much greater before the World War than it is now. During the World War when one source of bituminous coal, Great Britain, was cut off from Germany and its own transportation system was crippled, the lignite of the fields near Chemnitz and Zwickau had to be utilized, and proved efficient in the manufacture of electrical power. At the end of the World War, lignite had a higher value when used at the place of mining for the development of electricity than when it was shipped to the manufacturing regions as fuel. This new development in its use accounts, in part, for the decrease in the incoming tonnage of lignite into the lower Elbe division.

Another product of great importance in the upstream movement of raw materials is petroleum, half of which is destined for Berlin. Since Germany has practically no petroleum this product must be imported, and due to its bulky nature it is transported on the cheap waterways. Sulphur ore is destined largely for the chemical factories of the central German area. A small quantity of the sulphur ore goes to the ports of the upper Elbe where it is used in the hinterland as a spray for the vineyards. Salt, another raw material arriving at the seaports of the lower Elbe in large quantities, originates near the ports of the middle Elbe River traffic division. A great variety of other minerals enter the upstream and the downstream traffic on the lower Elbe, but since each is of slight importance, they will not be treated in this article.

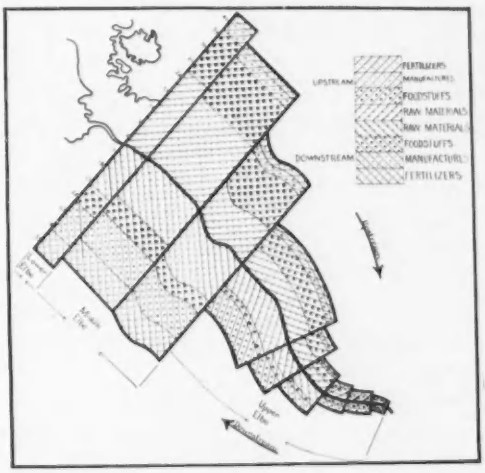

FIGURE 1.—Cumulative aspect of traffic on the Elbe from the source to the mouth.

The upstream tonnage of food products on the lower Elbe is three times as great as the downstream movement on the same division. The Elbe River flows through the central German plain which is cultivated intensively and scientifically. Since the area is also densely populated, the food that is raised in central Germany is not sufficient and varied enough to supply the demands of the dense population, and therefore it must be imported. Corn, wheat, and flour are imported in large quantities from the Americas and Russia.

Cattle raising has been encouraged in Germany, and because sufficient food for the cattle cannot be raised there, it must be imported. Linseed, rapeseed, and cottonseed oil cakes are high in oil content and make good cattle food. The

seeds are imported in large quantities and are sent to central Germany.

The leading food products of the downstream traffic are refined sugar, wheat, and flour which arrive at the lower Elbe ports from central and eastern Germany. Refined sugar is the most important of these food products and requires separate treatment. The quantity coming downstream is more than four times as great as the remaining food products. This heavy movement of sugar is due, in part, to the fact that the other two divisions of the Elbe River flow through an intensively cultivated sugar beet region.

The downstream movement of manufactures is nearly seven times as great as the upstream movement on the lower Elbe. Paper is the leading commodity of the downstream traffic of manufactured products. The Saale River and the upper Elbe flow for part of the way through mountainous regions covered with forests. Much of the lumber from the forests is used in the manufacture of paper, and the surplus paper is shipped out of the hinterland by way of the Elbe River, since it is bulky and non-perishable. The downstream movement of fertilizers on the Lower Elbe is nearly twice that of the upstream movement, although none of the fertilizers either originate or are used in the hinterland of the lower Elbe.

Ports of the Lower Elbe. The Lower Elbe traffic division has four important river ports, Hamburg, Harburg-Wilhelmsburg, Altona, and Lübeck. The group of ports, Hamburg, Harburg-Wilhelmsburg, and Altona taken together make up the largest river port on the Elbe and will be referred to hereafter as the port of Hamburg. Referring again to Figure 2 the importance of Hamburg to the hinterland of the Elbe as a river port and as a seaport is immediately noticeable.

Statistics show that nearly half of the total trade of Hamburg with its hinterland is brought in Elbe River craft. In view of the rapid development of railroads in the post-war years, it is surprising to find nearly half of the hinterland trade of Hamburg carried on by way of the Elbe River and its tributaries. In the trade of Hamburg with its hinterland, the percentage of the total export trade is considerably greater than the percentage of the total import trade carried on in Elbe River craft. This can be accounted for, in part, by the fact that bulky products such as coal, wheat, and cattle food are important exports to the hinterland of Hamburg and that manufactured products such as chemicals, scientific instruments, chinaware, and cotton cloth are imports from the same hinterland. Consequently, Hamburg exports into the hinterland the bulky products by way of the Elbe River but receives many finished products from the same hinterland by rail. We may conclude from the facts just stated that the Elbe River and the consequent commerce thereon are some of the prime factors in the development of Hamburg.

Hamburg has an area devoted to the handling of river craft in the harbor equal to more than half of the area devoted to ocean vessels. The entire water frontage of the harbor in 1932 was 105 miles. Of the water frontage, 35.5 miles are equipped for docking river craft while 43 miles are equipped for docking ocean vessels. The harbor at Hamburg is one of the best equipped harbors in the world. Its transshipping equipment from river craft to ocean vessel is one of the most modern available. It is equipped with electric cranes stationed at every hundred feet, each with a lifting power of several tons. Before a liner arrives, the import shed where the liner is to discharge and load is ready, and the barges lie in readiness

for unloading. Unless a barge has at least fifty tons of commodities for transshipment onto the ocean liner it cannot enter the basin for the ocean vessel but must discharge into a lighter which acts as a collector for the commodities of the various river craft. This method of handling small quantities of commodities prevents the clogging up of the basins for the ocean vessels with unwieldy river barges. As soon as the liner has tied up, the cranes bring out the cargo and swing it across to the waiting railroad cars or the empty barges. Seventeen per cent of the incoming cargo arriving in ocean vessels is loaded onto Elbe River craft in midstream. Thirty-three per cent is loaded onto Elbe River craft through the lighterage service.

The United Elbe Navigation Company has built in the Moldau barge basin at Hamburg a new pier for receiving and distributing barge cargoes of package freight. A shed has been constructed which extends out over the water of the harbor so that the barges or lighters may come right under it. Six barges may lie alongside each other to be loaded or unloaded. The commodities are lifted from the barges into the sheds where they are sorted, then by means of hatchways in the floor they can be placed on lighters which distribute them to various ocean vessels. The swarm of barges which must wait for a ship to arrive are fastened in river craft basins which are strung behind fan-shaped basins for ocean vessels. The river craft basins lead into each other and into the closed end of the basins for ocean vessels without interfering with the heavy traffic of the main stream. They are connected by a cut to the Elbe River above Hamburg so that they will cause the least disturbance possible to the ocean traffic of the port of Hamburg.

The port of Lübeck rose to commercial importance after the completion of the Elbe-Trave Canal in 1900 which connects Lübeck to the Elbe River. All

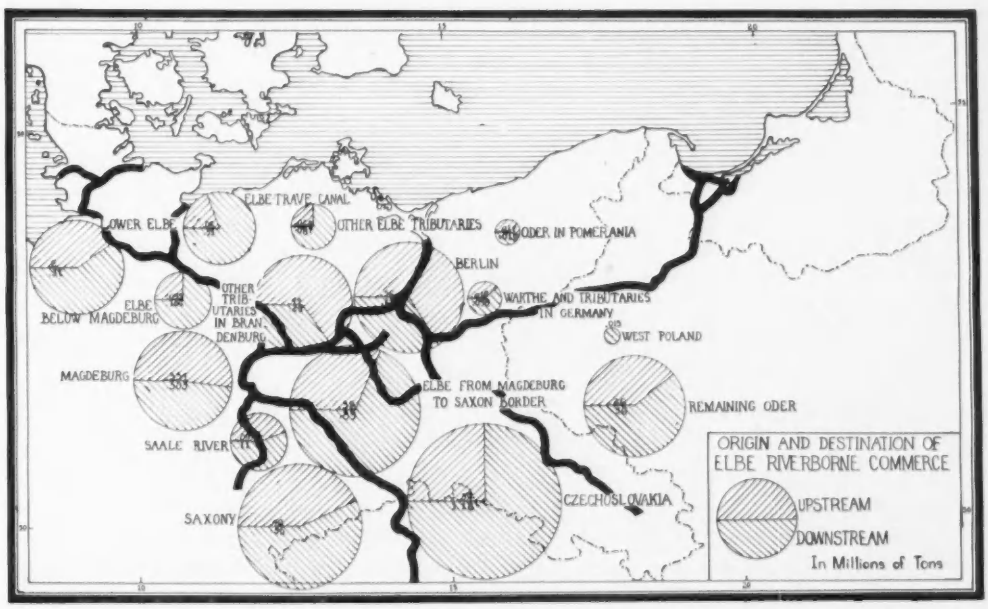

FIGURE 2.—Origin and destination of Elbe River-borne commerce. A large amount of Elbe traffic originates in the factories and mines of Czechoslovakia. The central area of Germany around Berlin contributes a large volume of traffic. A careful study of the respective circles discloses a greater downstream than upstream traffic. (Source: R. Schneider, Port of Hamburg. U. S. Government Printing Office, 1930.)

the commodities entering the harbor of Lübeck in ocean vessels, except those used locally, are destined for the Elbe hinterland, and likewise almost all of the commodities arriving at Lübeck in river craft had their origin in the Elbe hinterland and were transported by river craft. The trade of Lübeck is not stabilized, for the readjustments taking place in the eastern countries is likely to influence greatly the importance of this city.

The lower Elbe River traffic division carries the heaviest traffic. It is furthermore characterized by having an upstream and a downstream traffic which is nearly equal in the amount of tonnage. These characteristics of the lower Elbe River traffic division are due largely to the following conditions. Hamburg is the source and destination of most of the commodities moving on the Elbe River. The conditions for navigation on this division of the river are favorable for the free movement of large river craft and ocean vessels since that part of the river is naturally wide enough and deep enough for commercial activity without a large expenditure for channel improvements. Its very favorable position near a sea which is densely lined with world trade routes acts as a magnetic center drawing large quantities of commodities. The hinterland of that division of the Elbe is populated with an energetic people who have overcome many of the natural disadvantages such as low natural fertility, the lack of fuels, and the lack of raw materials.

THE MIDDLE ELBE RIVER TRAFFIC DIVISION

The tonnage carried on the middle Elbe traffic division ranks second among the divisions of the Elbe waterway. Of a total of 6,500,000 tons of commodities moved, 2,500,000 tons are carried in the upstream traffic, while 4,000,000 tons are carried in the downstream traffic.

The commodity movement on the middle Elbe traffic division is as varied as that of the lower division. Of the four commodity classes moving on the middle Elbe, raw materials rank first in the total amount shipped on this part of the river (Figure 4). Food products rank second, and manufactures, which are nearly equal to food products in the amount of tonnage moved, rank third as a commodity class on that division of the Elbe. The total tonnage of each of the latter two commodity classes is but little less than the total tonnage of raw materials. The total amount of fertilizer carried is about one-third of the total.

The surprising difference between the upstream and the downstream tonnage of raw materials on the middle Elbe is due, largely, to the following facts. The manufacturing area in and around Berlin imports many raw materials, and since Hamburg is the nearest German seaport to the world trade routes, many of the materials needed in Berlin are imported through the seaport of Hamburg and the network of waterways which radiate from the middle Elbe. Because few raw materials originate in or near Berlin, their downstream traffic on the middle Elbe does not increase greatly at the mouth of the Havel River, but large quantities moving downstream on the middle Elbe originate in the hinterland of the upper Elbe River traffic division.

Bituminous coal, coke, and mineral oil have the greatest tonnage in the upstream traffic of raw materials. Since there is no coal field near Berlin (Figure 5), the manufacturing area of that city must import the fuel which is necessary in the work of manufacturing. As a result, bituminous coal, coke, and petroleum are imported by way of the Elbe River and the waterways of the Mark (Figure 6). Most of the raw materials which originate in the hinterland of the

middle Elbe consist of salt which reaches the river at various middle Elbe ports. Small quantities of lignite enter the river traffic from the scattered lignite fields around Zwickau.

The tonnage of food products moving upstream is greater than the amount moving downstream. Grains, such as wheat, rye, barley, and corn, and cattle food are the food products moving upstream. Although the central German area is low in natural fertility, the same land is scientifically farmed, and through the application of fertilizer it is made to yield a high production per acre. The central German area is also densely populated and consequently even the high yield per acre of grains does not supply sufficient food for the needs of central Germany. As a result, food grains are imported into this region in large quantities and move in the upstream traffic.

The upstream movement of fertilizers is, approximately, only one-third of the downstream movement. In the upstream movement, both phosphate from Florida and Chile saltpeter figure largely. About half of those fertilizers leave the river at the ports of the middle Elbe to be used on the farms. All of the fertilizers which move downstream on the Elbe River enter the traffic at one of the middle Elbe ports. The hinterland has fields containing vast resources of potash and salt (Figure 5). It is from those fields that the fertilizer is obtained which is sent to the world market by way of the downstream traffic.

The movement of manufactures on the middle Elbe is characterized by great variety, none of them having a yearly tonnage greater than 1,000. Chemicals, paper, and paper pulp and glass are the leading manufactures in the downstream traffic while machinery leads in the upstream movement.

There are seven ports of mentionable importance along the middle Elbe. The

FIGURE 3.—Elbe River and the location of cities mentioned in the text.

ports are Magdeburg, Schönebeck, Aken, Barby, Wallwitzhafen, Halle, and Berlin. Of these Magdeburg is the most important river port in the amount of tonnage exchanged directly on the Elbe River. This may be due, to some extent, to the fact that Magdeburg is the largest city along the middle Elbe and has the greatest number of railroads focusing on it. Wallwitzhafen is a close second to Magdeburg in the tonnage transshipped from river craft to railroad. Wallwitzhafen handles a great many of the raw materials for the chemical industry in Dessau. Schönebeck, on the other hand, leads in the tonnage of commodities moving from rail to river craft. It is the chief port for the export of salt.

Aken's large outgoing tonnage of fertilizer is due, in part, to the fact that the Leuna Works at Merseburg make synthetic fertilizers which are shipped out through the port of Aken. This export together with the export of potash from the potash fields near Stassfurt has made Aken the leading fertilizer port.

Magdeburg is the second largest river port on the Elbe, the tonnage of raw materials ranking first in the total rail to river transshipments at Magdeburg. Bituminous coal, lignite, and petroleum

lead in the total upstream movement of raw materials. Most of the bituminous coal is used in the manufacture of iron and steel in Magdeburg, where the Cruson Iron and Steel Company, which is a branch of the famous Krupp firm in Essen, is located. The lignite which is imported is used largely in another industry in Magdeburg, that of sugar refining. Petroleum, another power fuel, also arrives in Magdeburg in large quantities and is probably used there. Since sugar beets cannot stand long transportation distances, many sugar beet factories making raw sugar are located throughout the sugar beet area. Sugar refining machinery is, however, expensive, and so the refining process is carried on in a few large factories with the result that much raw sugar is imported into Magdeburg.

The grains such as wheat and rye take the lead in the import of food products, which together with flour are probably used by the urban population of Magdeburg, since very little of it is transshipped from river craft to rail.

Fertilizers and manufactures rank third and fourth respectively in the upstream trade. The phosphate and Chile saltpeter are probably used in the synthetic fertilizer factories in and near Magdeburg, some of the remaining fertilizer no doubt being used on the sugar beet fields near by. The small amount of chemicals included in the class of manufactures is probably used in the sugar refining industry.

In the downstream traffic, the raw materials class again takes the lead. The shipments of salt from the salt mines at Stassfurt west of Magdeburg, far exceed the shipments of any other commodity (Figure 5).

Food products rank second in the downstream traffic. The leading food products are wheat, flour, and refined sugar, which make up nearly all of the tonnage of the food products class moving out through the harbor.

Magdeburg has attained the rank of most important middle Elbe port due, largely, to the central position of that port in the central German industrial region.

The ports of Schönebeck, Barby, Aken, and Wallwitzhafen are grouped together in this study for their respective trade is small, due to the fact that each is more or less a specialized port for the export and import of a particular commodity which is mined or manufactured in the immediate hinterland.

Salt is the chief commodity of the downstream traffic at Schönebeck. The salt mines already mentioned cover a large area and thus salt finds an outlet through many middle Elbe ports. Potash, too, is a very important product. The total of all the other commodities entering the downstream traffic at Schönebeck does not equal the movement of either salt or potash.

In the upstream traffic of Schönebeck, which is only one-tenth as great as the downstream traffic, phosphate fertilizer from Florida ranks high. Some of the phosphate is distributed to the farmers of the sugar beet region, for phosphate is an essential fertilizer in the high productivity of sugar beets per acre. A few tons of phosphate are also sent to the chemical factories which are numerous in that area.

The only commodities of sizeable quantities in the downstream traffic at Barby are the fertilizer from the potash mines and the salt from the salt fields near Stassfurt. Food grains are the chief commodities of the upstream movement.

Aken has risen to importance only since the World War. Due to Germany's inability to obtain nitrate fertilizer from Chile, German chemists devised a method of manufacturing syn-

thetic fertilizer, and plants for its manufacture were established in Aken. As a result, synthetic fertilizer is the chief commodity in the downstream traffic. Lignite, mined in the fields near Chemnitz, and refined sugar are the only other important commodities entering the downstream movement at Aken.

In the upstream movement foods rank high. As previously stated, much of the land in this region is used to raise sugar beets, consequently local food production does not supply the demand of that region, and food products must be imported.

Wallwitzhafen is the port through which Dessau ships out its synthetic fertilizer, and we find several thousand tons of fertilizer leaving this port. Refined sugar is also shipped out from the immediate hinterland of Wallwitzhafen.

The upstream traffic consists chiefly of a great variety of raw materials. Food products, such as wheat, rye, and cattle food, such as corn and bran, make up a tonnage of mentionable size.

The foregoing statements concerning the minor middle Elbe ports help to substantiate the fact that with the exception of the potash and salt fields, central Germany ranks low in natural resources which might stimulate a lively river traffic. Halle, located on the Saale, is a port of noteworthy importance in a consideration of the traffic on the middle Elbe. It is the terminus of river navigation on the Saale, and is situated at the place where the Frankfurt-on-the-Main railroad and the Berlin railroad meet, making it important as a port transshipping commodities into the hinterland.

Raw materials lead in the river to rail transshipments. Raw wool for the textile factories west of the Elbe takes

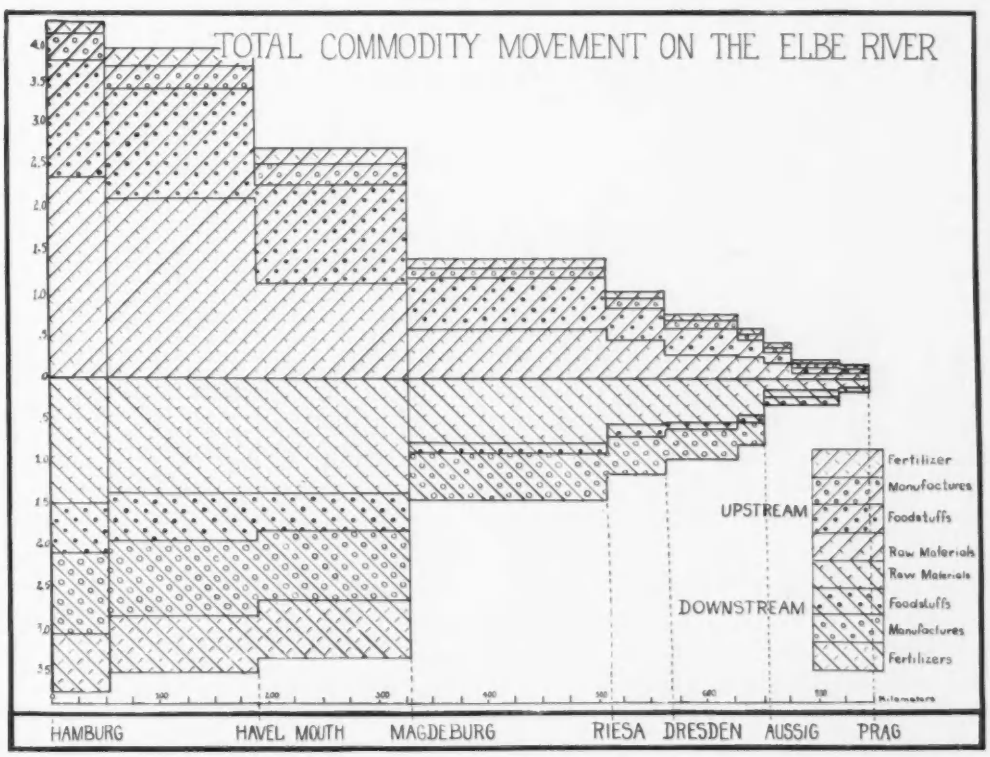

FIGURE 4.—The total commodity movement on the Elbe River. The cumulative aspect of the graph toward the downstream part of the river shows clearly that the upstream and downstream traffic on the river are very nearly balanced.

up a large part of the tonnage of raw materials. Among the incoming manufactures paper pulp is very important, because Halle and Leipzig are both towns in which book printing and binding is a leading industry. Paper is the only manufacture of importance that is shipped out of Halle.

Although Berlin is not located on the Elbe River nor on any of its tributaries, it belongs to the group of the middle Elbe ports for it carries on a considerable trade with the world markets by way of the Elbe and the Havel Rivers. Berlin is a gravity center for many of the commodities originating in eastern Germany and Poland, which after reaching Berlin find their way to the Elbe, for heavily loaded barges have access to favorable water conditions on the Elbe below the mouth of the Havel River. The Silesian "Trough" too, has a great variety of metals, which when loaded on barges need deep water to reach their destination at the seaport. The barges find conditions for navigation more favorable when they come by way of the canals to Berlin, to the Havel River and finally to the Elbe River, than when they go by way of the Finow to the sea.

The aforementioned ports are the only ports on the middle Elbe River traffic division which have developed a trade of significant importance. Many along the middle Elbe probably would develop a larger trade if it were not for the uncertain conditions relating to the depth of the water. During the periods when the water is very low, the amount of the traffic on the Elbe is noticeably reduced. After the normal river conditions have returned some of the river traffic that has been diverted during the periods of low water remains diverted.

Though small in volume of shipments, the middle Elbe River traffic division and the seven ports located along the river serve the central German industrial region, for the middle Elbe is a highway affording cheap transportation by means of which bulky commodities may be shipped.

The traffic on the middle Elbe is not great, largely because the natural resources of the hinterland are few and peculiar in nature for the potash and the salt do not stimulate the development of great manufactural areas.

THE UPPER ELBE RIVER TRAFFIC DIVISION

The tonnage of commodities carried on the upper Elbe traffic division is less than that on any other divsion of the Elbe waterway. Of the 1,900,000 tons carried 600,000 tons moved upstream and 1,300,000 tons moved downstream, making the downstream tonnage more than twice as great as the upstream tonnage.

The upper division of the Elbe River consists of two parts, the German upper Elbe which includes that part of the river flowing through the province of Saxony, and the Czechoslovakian upper Elbe which includes the navigable parts of the Elbe and Moldau rivers.

The volume of traffic on the upper division of the Elbe River can be accounted for, in part, by the following facts. Before the World War, the cities of the German upper Elbe had succeeded in obtaining a special tariff regulation from the Saxon railroads. The regulation provided that the railroads would haul commodities at a lower rate if they came to the upper Elbe hinterland by water than when they came to the same hinterland by way of the Prussian railroads. At that time commodities arriving by rail at the Saxon-Prussian border had to transfer from Prussian trains to Saxon trains, or from Saxon trains to Prussian trains. Consequently, it made no difference to the Saxon railroads if they handled the

commodities for a short haul from the Saxon-Prussian border to the destined hinterland or if they handled the short haul from one of the river ports to the same hinterland. Such regulations encouraged the development of river trade. Another factor in the development of the upper Elbe River traffic division is the fact that Czechoslovakia is a land-locked country. Her only outlet to the open sea is by way of the Elbe River. Consequently, all Czechoslovakian products seeking the world market by water had to make use of the Elbe River or the Danube River. Since the Danube River flows into an inland sea, most of the Czechoslovakian products leave by way of the Elbe River. River craft loaded with commodities can leave Czechoslovakian ports in bonded vessels and go to the free port at Hamburg as easily as if the river did not flow through a foreign country.

Raw materials lead in the movement of commodity classes on the upper division, and the volume of the upstream movement is nearly equal to that of the downstream movement. The raw materials are characterized by a great variety of commodities each moving in quantities of just a few thousand tons. The commodities which lead in the upstream movement are logs, porcelain, mineral ores, and the textile raw materials, such as cotton, wool, and jute. The upstream movement of mineral ores is explained largely by the fact that many of the mineral ores are shipped to Chemnitz from Dresden to be used in the work of manufacturing near the coal mines there, and by the fact that a few thousand tons of the mineral ores are shipped to the iron and steel manufacturing towns in and near Pilsen in Czechoslovakia. Nearly all of the raw materials moving upstream on the upper Elbe River have come from the seaports on the lower Elbe. The leading commodity of the downstream movement is lignite, most of which originates in the lignite fields near Pilsen in Czechoslovakia.

The mountainous region through which the Elbe must flow when passing through the upper Elbe River traffic division is covered with forests, from which much of the wood is sent downstream to the ship-building industry in Hamburg.

Manufactures rank second in the commodity movement on the upper Elbe traffic division. The upstream movement is practically insignificant, while refined sugar from Czechoslovakia makes up the largest part of the downstream movement. A large part of the Bohemian plain, like the central German plain, is devoted to the raising of sugar beets. Paper from the hinterland of the German upper Elbe makes up most of the remaining tonnage of manufactures.

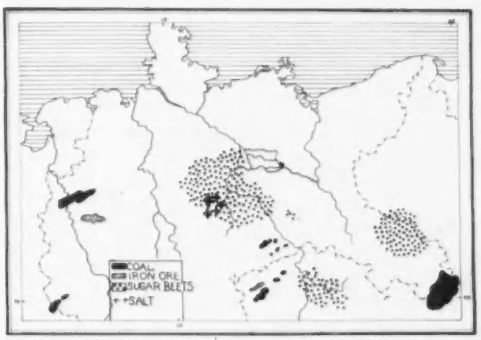

FIGURE 5.—Coal, iron ore, and salt areas of Germany. The sugar beet areas greatly influencing the volume of traffic on the Elbe are shown by dots. It will be noticed that little coal is found in the hinterland.

In the movement of food products, the upstream movement is nearly three times as great as the downstream movement. This can be accounted for by the fact that enough food is not raised for the dense population of the hinterland of the upper Elbe, the Bohemian plain being even more densely populated than

the central German plain. The movement of fertilizers on this part of the river is insignificant.

The ports of the upper Elbe River traffic division are few. The only ports having traffic of mentionable size are Riesa and Dresden. Those two ports owe their growth, in addition to the facts already stated, to the fact that they are located along the river at points where east and west railroads cross the river.

Of the two German upper Elbe ports, Riesa has the largest trade. Food products is the most important commodity class arriving at Riesa, and includes wheat, rye, and flour. In recent years the upstream movement of oil cakes has increased decidedly, due to the fact that much of the marginal farm land has been turned into grazing land. Textile raw materials for the scattered textile factories of this region, also arrive at Riesa in sizeable quantities. In the downstream traffic, raw materials of which nearly one-half of the tonnage is lignite, are most important. The downstream movement of food products is largely a movement of wheat. Paper is the leading manufacture shipped out of Riesa, since many small paper factories are located in the hinterland of the German upper Elbe River traffic division which make good use of the water power from the many small mountain streams.

The total upstream traffic at Dresden is nearly four times as great as the amount of tonnage in the downstream traffic. Food products rank first, this class of commodities consisting almost wholly of food grains and cattle food. Dresden is located along the Elbe River where the river valley has widened enough to permit a city to grow, but the valley is not large enough to supply land which will reproduce sufficient food for the population of that area, and it is again imported. The tonnage of food products sent downstream is insignificant.

Raw materials rank second in the upstream traffic at Dresden, and consist of a great variety of commodities each having a small tonnage. A great number of different raw materials are shipped downstream at Dresden but not one has acquired outstanding importance by having a large tonnage. Glass and paper are two manufactures of considerable importance moving downstream.

The ports of the upper Elbe in Czechoslovakia are more numerous than those in the German division. They may be divided into three groups. Aussig is the only port in the first group and is the largest Elbe River port in Czechoslovakia. The second group of ports consists of Laube, Tetchen, and Rosawitz. Prag, Melnik, and Lobositz make up the ports of the third group.

Aussig located at the confluence of the Elbe and the Bela rivers is the most important Czechoslovakian port. Of the total traffic in Czechoslovakia 65.3 per cent is focused on Aussig, which handles about 48 per cent of the incoming traffic and 72 per cent of the outgoing traffic. The data given show that most of the downstream traffic of Aussig consists of the movement of lignite coal. Coal is still by far the leading downstream commodity, coming from the mines in the mountains west of the Elbe. Czechoslovakia, rich in water power, a permanent resource, can send some of the coal to the countries less fortunate. Sugar, likewise, ranks high in the downstream traffic of Aussig, since sugar beet culture is intensive in the Bohemian Plain.

There is a great difference between the export tonnage and the import tonnage at Dresden resulting in considerable empty cargo space in the upstream traffic.

The importance of the Laube-Tetch-

en-Rosawitz group of ports lies more in the upstream movement of commodities than in the downstream movement. The chief upstream commodity is grain, an essential food product for a dense population. The second most important commodity of the upstream traffic is synthetic fertilizer. In the downstream movement wood takes the first place. The Bohemian forest in the west and the Sudetes in the east are heavily forested. It is from these forests that some of the lumber used in the building of ships in Hamburg comes. The conditions regarding the volume of the upstream traffic and the downstream traffic are the opposite of those found at Aussig. The river craft after discharging their cargo at the ports move to Aussig to carry a downstream cargo.

With the help of a special tariff similar to the one made for the upper Elbe ports of Germany, the Czechoslovakian government sought to aid the development of the upper harbors of the Elbe waterway, namely the ports of Melnik, Prag, and Lobositz, for they were not given such aid. The ports of the third group are developing rapidly, with the exception of Lobositz. Prag is chiefly a sugar and wood exporting city, and sugar is the chief commodity of the downstream traffic at Melnik also. The shipments of this third group of ports are practically the same as those in the second group and for the same reasons.

The commerce of the upper Elbe river traffic division gains significance largely through the tonnage contributed by the Czechoslovakian division of the river, though there are many commodities of small quantities. The traffic of the German upper Elbe is small, partly because the hinterland is restricted in agricultural productivity, the raw materials are few, and the industrial activity not great.

The trade of the Czechoslovakian ports, on the other hand is greater than that of the German ports, and it has increased decidedly within the last few years, for Czechoslovakia is now more than ever dependent upon the world market for food and raw materials. The export trade of Czechoslovakia is turning to the west by way of the Elbe rather than east by way of the Danube.

FIGURE 6.—The canal and river connections between Silesia and Elbe. The numerous canal connections between the Elbe and the Oder rivers facilitate the movement of products from Silesia to Hamburg, the port on the open sea.

SUMMARY AND CONCLUSIONS

In the investigation of the structure of Elbe River traffic the inter-relation of the commerce with the needs, the natural resources, and the industries of the hinterland is clearly evident, and the geographic structure involved is relatively simple.

Throughout this study it has been apparent that the commercial utilization of the Elbe River is closely related to the natural resources and the industries of the hinterland, and to the character of the stream. The volume and the character of the commodities shipped on the Elbe River depend upon the nature and the amount of the natural resources near the Elbe, the needs of the manufactural and farming industries in the urban and rural districts near that river, and the conditions of the river itself. Changes in the type of

commodity or the volume of the commodity moved on the Elbe are associated with changes in the needs of the industrial life of the hinterland and with the conditions for navigation on the river.

The downstream movement of salt and potash is related to the presence of those products in the hinterland of the Elbe west of Magdeburg. In the same way the downstream movement of refined sugar can be related to the fact that the Elbe flows through the chief sugar-beet producing areas of central Germany and Czechoslovakia.

In the upstream traffic the importance of bituminous coal and petroleum is a result of the lack of those two commodities in the immediate hinterland of the Elbe. The large amount of food grains and cattle food is related to the high density of the population and the relatively low natural fertility of the soil in parts of central Germany and Czechoslovakia.

The tonnage carried on the three traffic divisions of the Elbe River is one-tenth of the total tonnage carried on all German inland waterways. Elbe traffic has not assumed greater proportions for a number of reasons. The natural resources are localized, chiefly in the hinterland of the middle Elbe where valuable deposits of salt and potash are found. However, the remaining hinterland of the Elbe has few resources of mentionable importance. Quite naturally a greater traffic on the river would probably result if the hinterland had more natural resources, or if a commercial value would be found for natural material in the hinterland now considered worthless.

Since the fuels for great manufactural activity are largely lacking in the immediate hinterland of the Elbe, the number of factories is small, and therefore the volume of the upstream movement of raw materials and the downstream movement of manufactures is not great.

Thus man has utilized and improved the natural waterway he found in the Elbe River and its tributaries. He has made that highway of commerce serve as a means of moving commodities into and out of the hinterland of the Elbe River.

MINERAL RESOURCES OF THE WORLD

H. W. Straley, III

FOUR points are vital to consideration of mineral resources in connection with the present economic crisis. First, this is a mineral civilization, that is, one which is dependent upon the possession and production of certain essential minerals for its present high level, and which will be dependent upon the reserves of these materials for its future continuance. Second, the geographical distribution and extent of these reserves is known approximately. Third, the reserves are not sufficiently large to insure a continuance for long at the recent accelerated rate of production. Fourth, North America is more nearly self sufficient than any other geographical unit.

That modern civilization is largely dependent upon the products of the mine and smelter few will deny, but the extent of that dependence has, in all probability, escaped the attention of many. Before discussing quantitative comparisons, it is well to consider the homely illustration of John Doe going home from his work.

On leaving the steel and concrete structure in which his business is housed. Mr. Doe hurries along a concrete sidewalk to the transportation line. He boards a train of steel, or steel and wood, which is propelled by electricity derived, in general, from the combustion of coal. Upon descending from the train he is driven home in a metal automobile, the motive power of which is supplied by refined petroleum. His home is composed of clay-brick, concrete, or wood bound together with metal. Water and gas, and copper electric light and telephone wires, enter the building through metal conduits. During his meals, which are served in dishes of mineral products, the table is lighted by a tungsten filament surrounded by a bubble of sand.

The number of men employed in mining in this country is about 1,700,000, which is approximately the number engaged in railway transportation. In the United States, coal mining alone employs more men than any single manufacturing industry. One man in forty is engaged in underground work in the mines, while in Great Britain the proportion is even higher; one in ten. These figures are exclusive of those employed in fabricating the raw materials of the mines, and engaged in transporting and merchandizing them. Thus, the number of persons employed in mining, manufacturing, and distributing mineral products is a large proportion of the whole population.

TABLE I

COMPARATIVE INCREASE IN SOME OF THE MORE IMPORTANT ECONOMIC PHASES

	Per Cent Increase from 1899 to 1929
Population	62
Agricultural Production	48
Manufacturing (Physical volume)	210
Mineral Production	286
Consumption of Raw Energy	230
Installed Horsepower	536

TABLE II

COMPARATIVE INCREASE IN SOME OF THE MORE IMPORTANT ECONOMIC PHASES

	Per Cent Increase from 1899 to 1916
Population	36
Agricultural Production	62
Manufacturing Production	130
Mining	156
Railway Transportation	179
All Four Combined	80
Power	150

Tables I and II show the commanding position assumed in recent years by the mining industries. The manufactured products of mineral raw materials are, of course, included under manufactur-

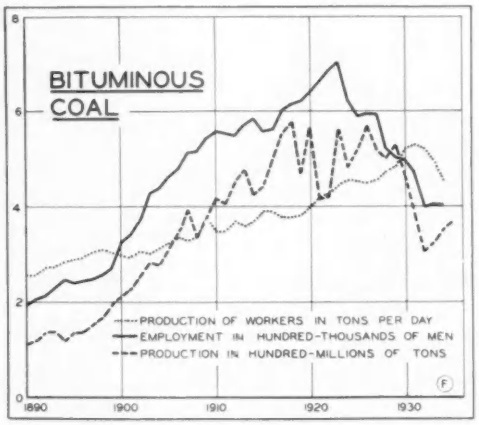

FIGURE 1.—Production of, productivity of the worker in, and production in the bituminous coal industry from 1890 to 1935.

ing in both tables. It is worthy of note that 93 per cent of the energy and power is derived from mineral products—coal, oil, and gas.

Railway traffic managers estimate that more than one-half of the total tonnage hauled by their roads is the product of the mines. Were they to include refinery and smelter products the estimate would be increased to three-fourths. The oil refineries alone furnish a tonnage greater than wheat, maize, oats, and all the small grains taken together. In these estimates the enormous tonnage of finished mineral product is neglected completely.

TABLE III

COMPARATIVE PRODUCTION AND CAPITAL VALUES

	Capital Invested	*Production or Service Value*
Steam Railways	$24,000,000,000	$6,000,000,000
Mines	12–15,000,000,000	6,600,000,000
Agriculture	.....	13,000,000,000
Added by manufacture of raw materials of mines....	.....	26,500,000,000

Table III shows the relative value of the capital invested in mines and railways, and the annual production or services of several industries. One sees from this table that the mines have a capital investment of a little more than half that of the railways, and that their annual yield is valued at a somewhat greater figure. The value of the products of the mines is about one-half that of the farm products, and when manufactured the total value is more than one and one-half times the value of the farm products and the railway services combined.

The above figures include, of course, the production of gold and silver, which amounted to 2,197,125, and 60,434,441 ounces respectively in 1927, and was valued at $45,418,600, and $34,266,328. These two metals find their major usage in coinage, ornaments, ornamental utensils, and jewelry. Minor uses of gold are in dentistry and the better grades of gilding; of silver, in alloys with gold and copper, in photography, and in medicine. Were it not for their scarcity value these two metals would find slightly greater use in the electrical industries. Enough gold and silver has already been mined to supply the use requirements of industry for many centuries; so that, one of the most useless acts of civilization is the mining of the so-called precious metals.

Leith, in his discussion of *World Minerals and World Politics*, makes a three-fold division of the essential minerals:

I. Coal, iron, and petroleum.
II. Copper, lead, zinc, and the fertilizers: nitrates, phosphate rock, potash, and sulphur.
III. The secondary minerals: aluminum (bauxite), antimony, asbestos, graphite, mercury, mica, and the alloy minerals: chromite, fluorspar, manganese, nickel, tungsten, and vanadium.

Of the first group he says: "The industrial position of a nation may be very well gauged by its consumption of power, which in turn is a function of the use of machines and fuels. Consequently it is hard to over-emphasize the importance of iron out of which ma-

chines are made, and of mineral fuels which propel them." In the second group are placed those minerals which are vital to national welfare, but which do not occupy so outstanding a place as do those of the first group. The third group comprises what may be termed the *accessory minerals*, which are valuable contributors to a high level of civilization, but are not absolutely essential to national power and industrial development.

Leith says of the third group: "Countries possessing the secondary minerals must be given a lower ranking on the ground that no combination of these minerals will yield industrial power and that they will be tributary to industry based on the first two groups." Such being the case, attention will be concentrated in this survey upon the first two groups with special emphasis on the fuels and iron.

In order to extract, transport, and manufacture the products of the mines, some source of energy must be tapped. Man and the domestic animals have become negligible as sources of energy on the scale demanded by modern industry. There are two possible energy sources aside from the mineral fuels—the combustion or distillation of vegetation, and the harnessing of the waterfall.

Charcoal was the first important fuel used in the iron industry. During the eighteenth century Great Britain was practically denuded of forests to supply the demands of this industry. At one time the growth of the iron and steel industry was at a standstill for lack of fuel until coal finally and completely displaced charcoal. Even though agricultural practice advance to a point where forests become more numerous, and the efficiency of the wood burning engine be magnified many times, there is small likelihood that there will be a return, for many centuries at least, to the general use of wood as fuel. Even great advances in the production of synthetic vegetable fuels are unlikely to cause an immediate major shift away from coal and oil as the chief energy sources.

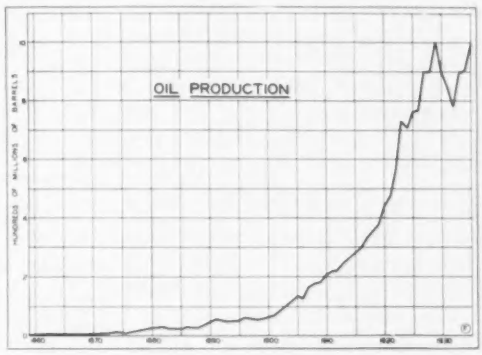

FIGURE 2.—Production of crude oil in the United States from 1860 to 1935.

Water power, which today produces but 7 per cent of the energy used in the United States, will in time become a competitor. The potential resources are sufficient to bear almost one-half of the present power load, if developed to their fullest capacity. Although its importance may be exaggerated at present, its future development to a position of major importance is only a matter of time. Hydro-electricity will eventually motivate a larger proportion of stationary engines and locomotives, thereby releasing large quantities of coal for destructive distillation to supply the ever increasing demands of the internal combustion engine.

Figures 1, 2, 3, 4, 5, 6, 7, and 8 show that the productions of the fuels, iron, copper, lead, and zinc, the fertilizers, and the use of energy have increased markedly in the U. S. A. during the last thirty years.

Whether a high energy consumption civilization is good or bad for man is a matter of philosophical speculation. The fact is that such a social environment exists and it behooves one to consider the basic substances upon which it

operates. As the mineral capital is being used at the rate indicated, it becomes advisable to look into the matter of reserves.

It will come, no doubt, as a surprise to many to learn that the geologist can give fairly close estimates of the amount and distribution of the essential minerals left underground. As pointed out by Leith, modern industry operates on such a scale that only those deposits which may be mined for years count materially as ore reserves. While the detailed areal geology of the world is far from well known, it is safe to say that almost all the deposits of outstanding commercial possibilities have been discovered. There remain only small, scattered ore pockets which may be discovered by the individual prospector, or, more likely, by the highly organized scientific effort of a large and powerful corporation. The writer does not imply that deposits upon which small local industry may be founded will not be discovered, but that the geography of the large mining areas of the future and their approximate importance is predictable.

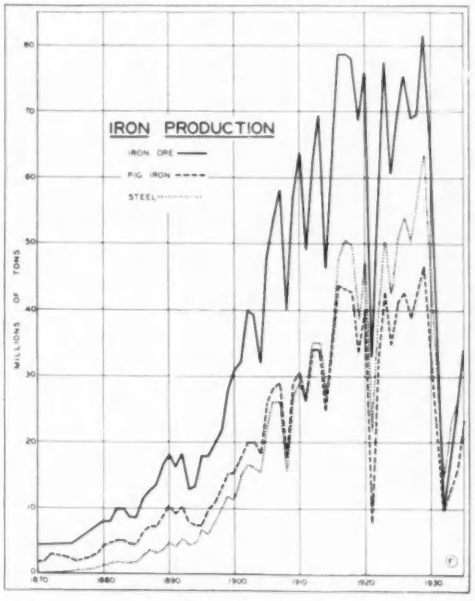

FIGURE 4.—Production of iron ore, pig iron, and steel in the United States from 1870 to 1935.

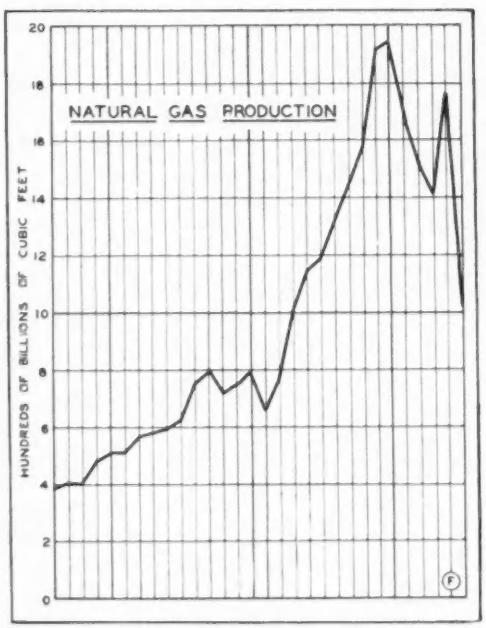

FIGURE 3.—Production of natural gas in the United States from 1906 to 1935.

In prospecting for coal it would be folly to send geologists into pre-Cambrian areas, where only one large deposit is known, and that of such a graphitic nature as to be of no commercial value. The same may be said of granite and other igneous areas, for neither coal nor oil is found associated often with such rocks. In searching for oil it is usually wasteful to prospect areas where deformation has been intense, for the forces acting have, as a rule, dissipated the petroleum. Equally strict conditions govern the location of deposits of other minerals.

TABLE IV

COAL PRODUCTION AND RESERVES

	Production		*Reserves*	
	Per Cent		*Per Cent*	*Million Tons*
United States	46		54	3,838,657
Canada	..		16	1,234,269
Asia	..		17	1,279,586
Europe	..		1	784,190
Germany	22		..	.....
Great Britain	10		..	.....
France	4		..	.....
Oceania	..		..	170,410
Africa	..		..	57,839
South America	..		..	32,097

Table IV shows that in the case of coal reserves North America is in a far better position than any other geographical unit, having 70 per cent of the known reserves.

Table V indicates that North America is the best endowed unit with respect to petroleum reserves. Even so, it is important that the United States is using 72 per cent of the total world oil production, while producing only 68 per cent. This does not argue well for long continued self-sufficiency unless synthetic fuels can be produced more abundantly, or the efficiency of the internal combustion engine can be increased.

TABLE V

PETROLEUM PRODUCTION AND RESERVES

	Production	*Reserves*	
	Per Cent	*Per Cent*	*Million Bbls.*
United States	68	48	12,000
Russia	6.4	12	3,000
Irak	..	10	2,500
Venezuela	8	8	2,000
Mexico	3.8	..	300
Persia	3.8	9	2,200
Netherlands' East Indies	2.4	4	1,000
Rumania	2.3	..	500
Colombia	1.5	..	400

Table VI shows that North America has over 67 per cent of the known iron reserves of the world. So that, with respect to minerals of group I, this continent is far better provided than any other.

According to Leith (Quoted in ch. i, *Mineral Economics*), more mineral products have been used in the last twenty-five years than in the whole of recorded history previous to the twentieth century. In speaking of the reserve ratio (*Mineral Economics*), he says: "To illustrate: If twenty years ago there were 20 units of reserve behind one unit of production, and the present production is now three units (a not unusual increase) the reserve necessary to maintain the ratio would be 60 units. It does not do simply to find each year an amount equal to production for that year. . . . As a matter of fact, present economic conditions require even larger

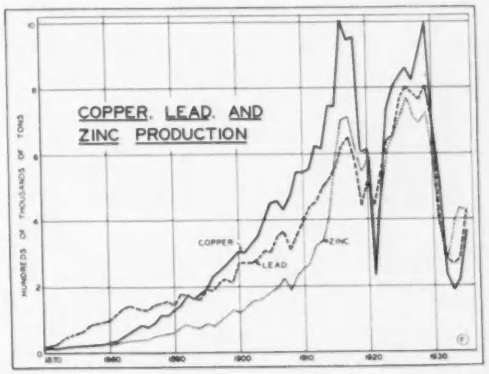

FIGURE 5.—Production of copper, lead, and zinc in the United States from 1870 to 1935.

reserve ratios than in the past." Tryon and Berquist (*Mineral Economics*) estimate that in the hundred years preceding the World War the white population of the world increased three fold, while the consumption of metals and mineral fuels increased 75 to 100 fold. Hewett (*Mineral Economics*) says that the production of iron increased steadily during the last century: Sweden, 10 times; Belgium and France, 20 times; Russia, 30 times; Austro-Hungary, 40 times; Great Britain, 50 times; Germany, 300 times; and the United States, 700 times.

Consideration of these figures makes one doubtful whether the iron reserves, large as they undoubtedly are, can support an increase in the next century of 700 times the present production. It is even more improbable that the energy sources are sufficient to produce and fabricate this large quantity of iron—of the order of magnitude of 30,000,000,000 tons per annum. The rapid exhaustion of existing energy supplies becomes more apparent when one recalls the huge quantities diverted into the production of other goods attendant upon such an expansion. As has been pointed out elsewhere, it is more probable that industrial activity will tend toward a more constant level within the near future.

Hewett, from a study of European

TABLE VI

IRON PRODUCTION AND RESERVES

	Production	Reserves	
	Per Cent	*Per Cent*	*Million Tons*
United States	36.5	62	39,525.6
Europe	....	26	16,817.4
France, Germany, Luxemburg	36.1	..	.....
Great Britain	6.6	..	.....
Russia	3.5	..	.....
Spain	3.3	..	.....
Sweden	2.7	..	.....
Austria	1.1	..	.....
Czechoslovakia	1.0	..	.....
South America	...	5	3,057
Newfoundland	1.0	3	1,961
Cuba	...	2	1,310.8
Asia	...	..	438.3
India	1.0	..	.....
Africa	...	..	75
Algeria	1.1	..	.....
Australia	...	..	73.8
Mexico	...	..	30

production statistics, has deduced a diagram which indicates "five stages, shown by successive culminations of (1) the quantity of exports of crude ore, (2) the number of mines in operation, (3) the number of smelters and refining units in operation, (4) the production of metal from domestic ore, and (5) the quantity of imports of crude ore." In spite of the fact that such a diagram is empirical it gives a fairly definite check on the position of any field, or country, in the cycle of mineral production, or its industrial position. He says that, "in the United States I have noted the same tendency; first a peak in the number of mines in operation, next a peak in the number of smelting and refining units, and then peaks in production of metals. That the peak production of the metals from many of the principal districts, especially in our Rocky Mountain and Sierra states, has been passed as long as present price levels continue, I firmly believe." He further states that, "Measured by district production curves, many of our outstanding districts of a few years ago show signs of exhaustion, and we are sustaining or increasing national totals by turning quickly to new sources of lower grade. If science and technology can keep pace, we have no cause for concern. Personally, I doubt that they can much longer."

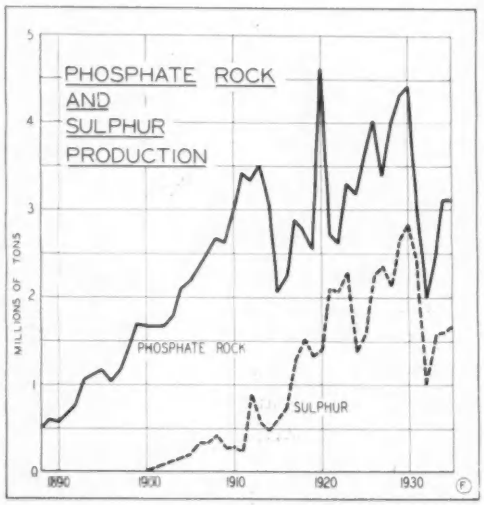

FIGURE 6.—Production of phosphate rock and of sulphur in the United States from 1878 to 1935.

Table VII shows the status of North America as to the essential and secondary minerals. Of the minerals in group I the continent is adequately supplied, with the exception of petroleum which must be carefully conserved, and efforts made to bring in new fields and to devise substitute fuels. The supply of the minerals of group II is adequate, except for the nitrates, which can be produced synthetically on such a scale that the mineral can be forced out of competition. Question may be raised as to the adequacy of the potash reserves, but re-

cent studies indicate that extensive deposits are to be found in west Texas and New Mexico.

North America must continue to import several of the secondary minerals: antimony, chromite, fluorspar, manganese, tin, tungsten, and vanadium. Mexico may perhaps be relied upon for mercury; Canada and Central America, for mica; Canada will supply the deficiency of the United States in graphite and nickel.

When it is pointed out that approximately 150 million tons of coal are wasted annually in mining, the question is often asked, "Is it possible to conserve these resources by less wasteful mining methods?" Were the industry controlled by a body interested primarily in ultimate production rather than *immediate profits*, the answer would be in the affirmative.

Particularly is the petroleum industry in need of conservation methods. The practice of permitting gas wells to "blow" in the hope of stimulating a flow of oil is, unfortunately, still too common. This is not only wasteful of gas, but the diminution of gas pressure leads to a smaller total oil yield. In order to prevent drainage of a lease by its neighbors, it is often necessary to drill boundary

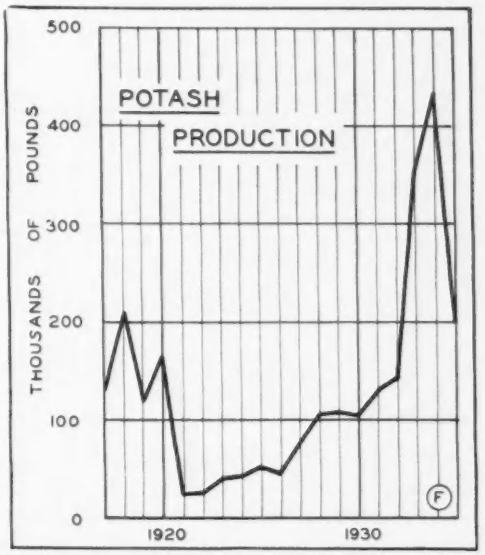

FIGURE 7.—Production of potash in the United States from 1917 to 1935.

TABLE VII

NORTH AMERICA'S STORE OF MINERALS

	A	*B*		*C*	*D*
	United States			*Continent*	
	Suf.	*Insuf.*	*Add. Sup.*	*Suf.*	*Insuf.*
Coal	x	..	Canada	x	..
Petroleum	..	x	Canada, Mexico	?	..
Iron	x	..	Cuba, Canada	x	..
Copper	x	..	Mexico	x	..
Lead	x	..		x	..
Zinc	x	..		x	..
Fertilizers—Nitrates	..	x	Synthetic	x	..
Phosphate	x	..		x	..
Potash	x	..		x	..
Sulphur	x	..		x	..
Aluminum (bauxite)	x	..		x	..
Antimony	..	x	Canada, Mexico	..	x
Asbestos	..	x	Canada	x	..
Graphite	..	x	Canada	x	..
Mercury	..	x	Mexico	?	..
Mica	..	x	Canada, C. A.	x	..
Tin	..	x		..	x
Alloy minerals—Chromite	..	x	Cuba	..	x
Fluorspar	..	x		..	x
Manganese	..	x	Cuba	..	x
Nickel	..	x	Canada	x	..
Tungsten	..	x		..	x
Vanadium	..	x		..	x

At the present rate of production:
A = Available in large quantities for export.
B = Available to meet domestic needs.
C = Inadequate to meet domestic needs.
D = Almost entirely dependent.

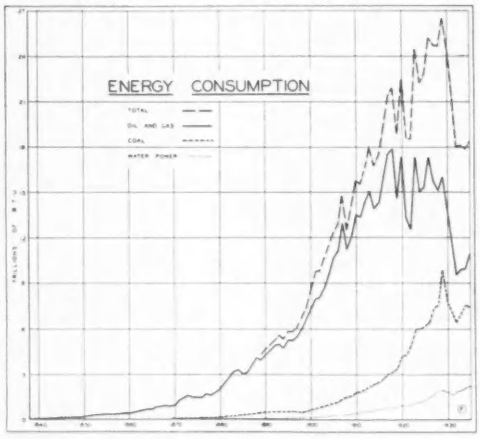

FIGURE 8.—Consumption of energy in the United States from 1840 to 1935, and its distribution between coal, petroleum, and water power as sources of energy.

and offset wells. This practice also decreases the gas pressure and thereby the total production of the area. Other examples could be mentioned, connected with water troubles, for instance, to show that more efficient and less costly methods could be instituted, that would lead to higher ultimate recovery.

In conclusion, there are four main points which should be stressed: first, civilization is dependent for its material progress upon the products of the mine and smelter; second, the location and size of the reserves of the necessary minerals are known, with a fair degree of accuracy; third, these reserves are by no means large enough to support an expansion of industry in the future comparable to that of the immediate past; fourth, North America is more nearly self-sufficient than any other geographical unit.

GREENLAND: A PRODUCTIVE ARCTIC COLONY

Herman R. Friis

GREENLAND, first settled by Europeans in 996, has experienced the vicissitudes associated with being on the fringe of civilization. Despite its isolation and location in the Arctic, Greenland, under the intelligent and progressive guidance of Denmark, has become a nearly self-supporting colony. Settlement and civilization of the native Greenlanders has been carried to a high degree of perfection. The island today is the outstanding example of progressive colonial government in the Polar regions.

Locational Facts

The physical lineaments of Greenland are defined naturally on all sides by the contact between land and water (Figure 1). However, the geographic region of which Greenland forms the nucleus is somewhat larger areally, for it comprises, in addition to the land mass, a considerable area of the seas surrounding the island. This water body is the vitally important element of the physical environment upon which the Greenland culture has been largely dependent throughout its evolution.

Greenland is the largest island in the world. It extends through nearly twenty-four degrees of latitude (60°N–84°N) or about 1,650 miles in its greatest length, and sixty degrees of longitude (10° 20′ W–70° 20′ W) or about 700 miles in its greatest breadth. The total land area is somewhat greater than 1,250,000 square miles. The area of exposed land is approximately 225,000 square miles, of which 193,000 square miles is in "outer land" and 32,000 square miles in coastal islands.

Because of its arctic location the interior of the island, rising everywhere to a considerable elevation, is permanently covered by a huge ice cap. This vast mantle of ice is doubly significant, for not only does it make up nearly nine-tenths of the area of the island, but it has a significant effect upon the climate, vegetation, and human activity of the narrow fringe of exposed land circumjacent to its outer margin. From this vast, frigid, ice-covered interior extend many lobes of live glaciers which in numerous places move out to meet the waters of the seas, though this char-

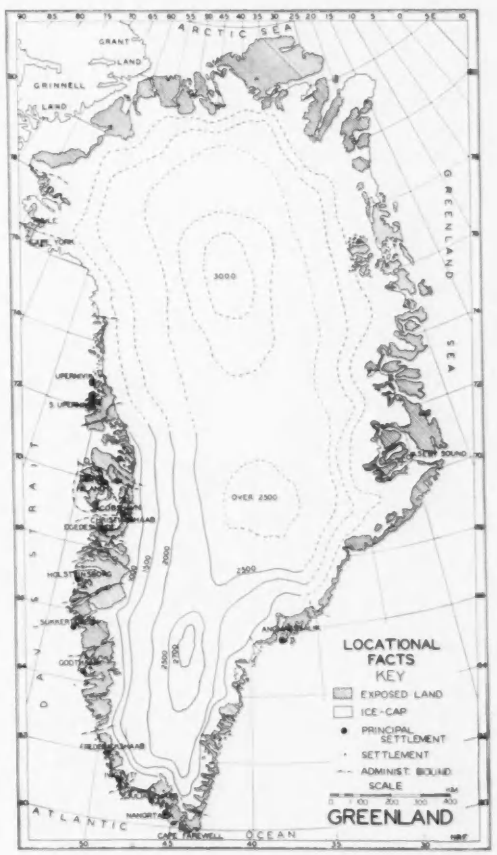

FIGURE 1.—Principal features of Greenland as discussed in the text.

acteristic is more evident on the east and north coasts than on the west and south. The land comprising the coast thus presents a patchwork of innumerable islands, bays, fiords, fiards, and sounds peripheral to which are the habitable patches of exposed land.

PHYSIOGRAPHY

Greenland is an ice-capped plateau girdled by a fringe of land consisting of a considerable number of different kinds of land forms (Figures 1 and 2).

From a crest somewhat east of the longitudinal middle of the island the ice extends as a relatively flat, though occasionally step-like sloping surface. This flatness, however, is not continuous, for in some places it is broken up by crevasses, in others it is hummocked by differential melting, or incised by summer-developed, intermittent water courses which have cut deep canyon-like valleys, suddenly to disappear into subterranean passages. Where nunataks or smaller rock islands protrude the heat-radiating rocks produce a system of gullies in the ice. In addition, during the summer the surface is dotted with numerous shallow-water depressions and cryoconite holes whose bottoms, a few feet below the surface, are filled with fine, wind-blown mud. The calving of ice in the heads of the fiords is a universal feature of the ice margin which terminates in a steep slope fronting onto the exposed land.

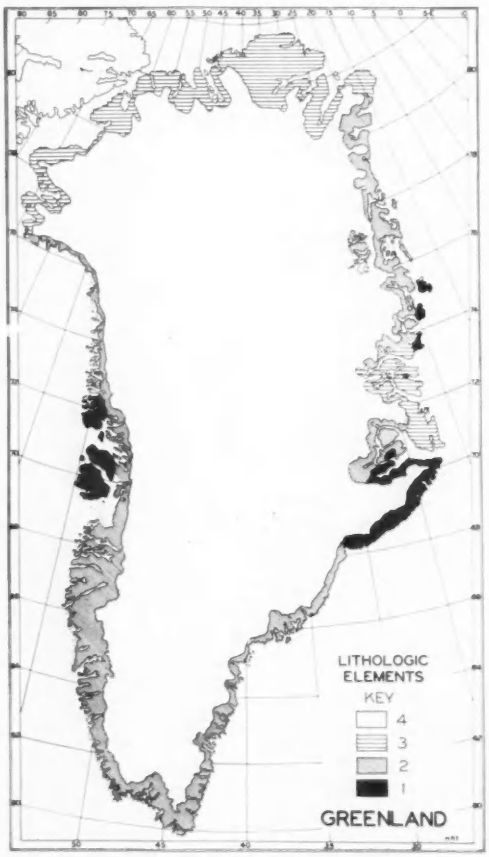

FIGURE 2.—Principal lithologic elements of the exposed and known areas of Greenland.

Key to numerals:
1. Areas predominantly basalts.
2. Areas predominantly gneiss.
3. Areas predominantly sediments.
4. Inland ice.

(Principal source, *Meddelelser om Grønland*, Volumes 60–61, 1926.)

The land exposed margin of Greenland is essentially a region of ice-scoured or ice-plucked topography with an average elevation of about 3,000 feet. Precipitous slopes, girdled with cirques, great local relief, numerous wide, glacier-filled, U-shaped valleys grading into the fiords, rochés moutonnées, bare rock surfaces, striated and smoothly polished and rounded crests, characterize much of the mountain region of the coast where granite, gneiss, and some metamorphosed sediments are the principal rocks. Most of the valley bottoms tributary to the sea are filled with live glaciers still actively scouring out the lowlands. Some areas of mountain topography, especially the more elevated portions, present a sharp, steep, angular profile, a post-glacial condition which is a product of denudational activity, the rock débris being carried either by glaciers or running water to the coastal margins where it is deposited. The accumulation of talus at the base of steep

declivities is everywhere conspicuous and further evidence of the considerable effectiveness of physical weathering, especially frost action (Figure 3).

In the areas of basalt, plateau topography is common. These plateaus frequently present an extensive, flat, horizontal surface which has been much dissected into U-shaped, often glacier-filled valleys, tributary to the sea (Figure 3). The average elevation is about 2,500 feet. Terrace or bench-like profiles are common, the sheer valley cliffs towering upward in a succession of steps. Where the plateau fronts onto the sea, deep fiords extend inland, rock walls plunging abruptly into their ice-flecked waters.

The coastal margin—the contact between land and water—is extremely irregular, consisting of innumerable fiords, peninsulas, islands, and skerries, and is very properly called "Skaergaard" or skerry fence (Figure 4). In the areas of gneiss, notably along the south coast, the long, narrow fiords are usually at right angles to the coast line, being the drowned portions of long straight-channeled valleys which often extend back to the inland ice. In areas of sedimentary rocks the fiords branch irregularly and do not extend as far inland. Areas of flat littoral are limited both in size and in number to the heads of fiords where glacio-fluviatile sediments are being deposited. Often sand dunes fringe the margins of these beaches, and back of the dunes are lagoons and salt or fresh water marshes.

The east coast as contrasted with the west coast possesses a greater variety of landscapes in terms of local relief. There the mountains are higher, the plateau surfaces are more deeply dissected and intricately benched and faceted, the fiords are longer, deeper, and steeper-walled, and the narrow lowland shoreline frequently abuts abruptly onto the steep slopes of high mountain topography.

FIGURE 3.—View of Godhavn harbor, Disko Island, as seen from the governor's house. (Courtesy of Dr. J. E. Church.)

CLIMATE, VEGETATION AND SOILS

According to Koeppen's classification Greenland has an ET and an EF climate; the former, a tundra association, is confined to the margins, roughly the exposed land, and the latter to the ice-covered interior.

The climate of the island is characterized by contrasts between the inland ice and the margins and by the progressively more truly polar climate of the coastal margins from south to north (Table I). This is best shown in the northward decrease in: (1) mean daily and annual temperature, (2) average annual precipitation, (3) length of the frost-free season, (4) number of days of potential sunshine, and (5) solar radiation. In addition, the southern part of the island is seasonally affected by its relative proximity to the cyclonic storm tracks. The glacial anticyclone, a product of the refrigerated inland area, gives rise to pulsations in the drainage or flow of cold air toward and out over the coastal margin. Hence, successions of calms and blizzards are felt along this periphery.

Because of the narrowness and limited area of exposed marginal lands, land-heating is somewhat restricted but still has a significant effect for it brings about a sea-to-land indraft of cold masses of fog-laden air during the summer months. The winter months are characterized by occasional "warm waves" of short duration associated with a "high" amount of precipitation. The foehn wind of this season is a prominent climatic element. It is fickle wind, blowing in violent gusts, with variable dryness and temperature which fluctuate considerably in their range.

Climate, topography, and location appear to be the critical elements determining the kinds and distribution of plants on the island (Figure 5). Almost total lack of plant life on the inland ice limits the vegetation cover to the land margins where it reflects the north-south transition in climate and as well the changes from the shore to the inland ice.

Vegetation, characteristically tundra in kind, is generally limited to the west coast. The most luxuriant cover is in the southwest from Julianehaab to Disko Island, where, on the more protected soil-mantled surfaces, rather extensive copses of birches and willows, sometimes 15 to 20 feet high, spread over a dense matting of perennials, such as grasses, mosses, and lichens, and often are interspersed with stunted alders, gnarled junipers, and mountain ash. Perennial herbs and grasses sometimes occur in considerable spreads on the lower gradual incline of talus slopes, and as meadows or heaths in shady hollows or depressions. They may often cover considerable areas of the relatively flat-topped uplands in the south, where they afford good pasture for the livestock.

This plant association blends gradually northward into the grass tundra which is interspersed in the more favorable places by bush and meadow formations that frequently include a prolific growth of small shrubs, herbs, bracken, and mosses and during the short summer season may be carpeted in a wealth of brilliantly colored flowers. In less favored places bush heath, moss-covered, lichen-fringed swamps in inland depressions are frequent. Plants growing in the more elevated portions of the coast have attempted to adapt themselves

FIGURE 4.—View of Godhavn harbor as seen from Disko Cliffs. This photograph well illustrates the "Skaergaard" or skerry fence characteristic of much of the coastal strip of Greenland. (Courtesy of Dr. J. E. Church.)

to the severe drying effect of the foehn by frequenting the moister, more protected habitats and the lee margins of boulders and rock blocks.

These plant associations characterize fairly well the vegetation of the coast to somewhat north of Upernivik where they blend into the more truly polar variety. Limitation in the number of species, in the kinds of plants and in their lower order of complexity, sets the northern half of the island apart from the southern. Lower summer temperature, limited, ice-free, soil-covered surface and considerably less precipitation are in part responsible for these nearly physiologically arid conditions. The vegetation cover is restricted to isolated patches of stunted bushes, heaths, mosses, lichens, and the low-lying varieties of the so-called cushion and mat plants. Where agglomerations of plants occur it is usually as small bogs and meadows in hollows or protected south-facing slopes.

Soil is distinctly a local condition being restricted in distribution to depressions, relatively flat, protected uplands, and to the margins of water courses, especially such as are of glacio-fluviatile origin. The soil is fundamentally of the tundra variety, possessing a shallow profile, an acid humus surface layer which is often underlain by a shallow plastic or nearly fluid loam of from a few inches to several feet in thickness resting upon a permanently frozen subsoil. Several of the more extensive grass-covered plateau regions of the south have a soil mantle of wind-deposited glacio-fluviatile muds. The soils are mostly poorly drained and tend to bogginess because of the underlying permanently frozen subsoil.

Solifluction is conspicuous of nearly every soil-covered area and where most pronounced, that is, where the soil is moving rapidly, paucity of vegetation is markedly evident. Likewise, polygon soil formation is nearly everywhere apparent.

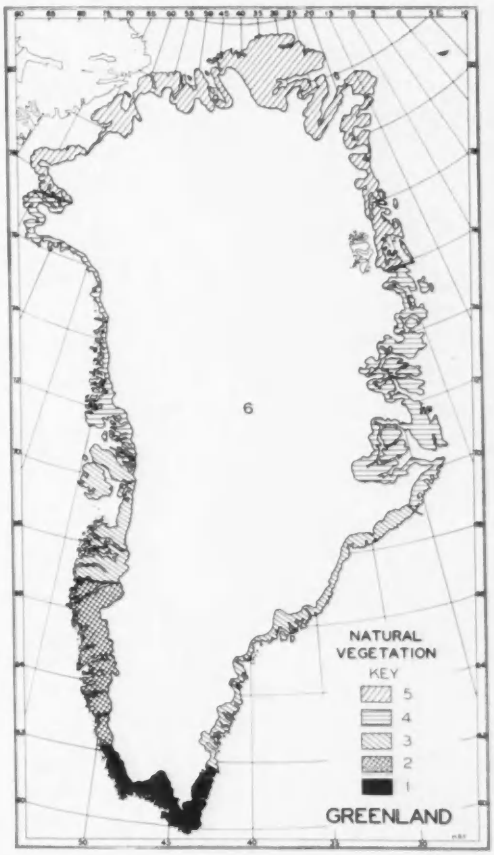

FIGURE 5.—Distribution of the principal associations of natural vegetation.

Key to numerals:

1. Southern "forest," bush and shrub forms. Willows and birch are dominant and in addition grasses, flowers, mosses, lichens, and heath.
2. Same as (1) but with greater limitation of area in plant cover, a dwarfing of trees, especially birch, and a decrease in bush formation.
3. Dwarfed willow copses, infrequent and small bush cover, and a dominance of grasses, mosses, and wild flowers.
4. Absence of tree growth, a few stunted shrubs, and a dominance of lichens, grasses, mosses, and heath.
5. High arctic plants of low form, i.e. grasses, flowers, mosses, and lichens in restricted areas.
6. Botanically arid.

Upon this physical landscape the present culture has evolved, in part reflecting the limitations and severity of

the environment, and in part modifying the landscape to fit a changing culture form.

SEQUENT OCCUPANCE

Commercial relations between Greenland and the Scandinavian countries, and the attendant settlement of Greenland by the Scandinavians has been more or less continuous since the initial establishment of colonies in the southern part by Erik the Red at the close of the tenth century. However, there have been periods since the founding of these settlements during which Greenland was left completely isolated from the world outside. Considering the sequent occupance of Greenland from the time Europeans first settled there, several different periods are apparent.

LANDSCAPE FEATURES OF NORSE SETTLEMENT (996–1500)

Erik the Red and his band of Norsemen, the first Europeans known to settle in Greenland, were agriculturalists from the beginning. These early Norse folk settled the most favorable part of the island, the southwest, extending from Julianehaab to Godthaab (Figure 6). Settlement was not agglomerated about one or two fiords, but was dispersed as individual farms or small groups of farms on the flat, relatively fertile areas at or near the heads of the deep, well-protected fiords, or on the gently undulating uplands which occasionally slope away from the walls of the fiord. Often the farm houses and barnyard were situated on the bay head where a stream or river passed swiftly by. This kind of site was most sought after because it

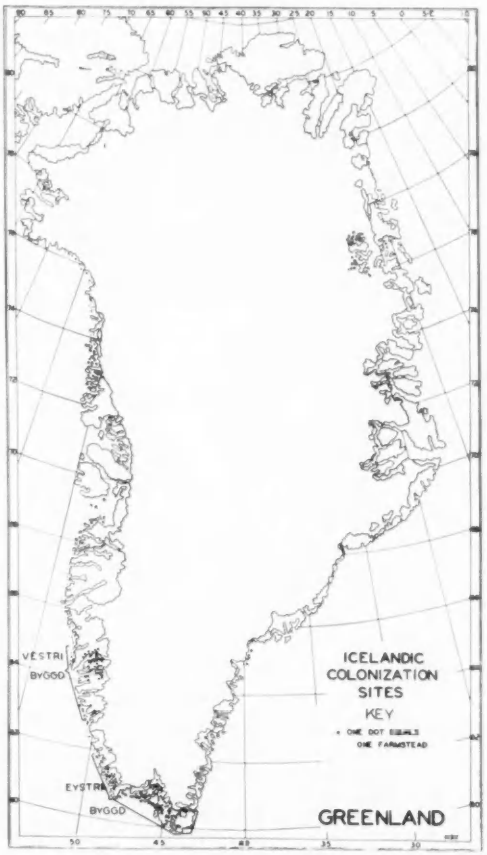

FIGURE 6.—Distribution of the two principal areas of Greenland settled during the Norse period. (Principal source, *Meddelelser om Grønland*, Volumes 60–61, 1926.)

TABLE I

CLIMATIC DATA

Station	N. Lat.	W. Long.	Average Temperature (°C) Feb.	July	Year	Absolute Extremes (°C) Max.	Min.	Precipitation M M	Days Below 0° C
West Coast									
Ivigtut	61° 12′	48° 11′	− 7.5°	9.7°	0.5°	23.4°	−28.9°	1170	208
Godthaab	64° 10′	51° 43′	−10.0°	6.6°	− 2.0°	24.2°	−28.9°	668	225
Jacobshavn	69° 13′	50° 55′	−19.0°	7.7°	− 5.7°	19.4°	−42.0°	215	256
Upernivik	72° 47′	55° 53′	−22.8°	5.0°	− 8.7°	17.8°	−40.4°	235	290
N W Greenland	82° 0′	63° 45′	−37.5°	3.2°	−18.8°	10.5°	−52.1°	100	(295)
East Coast									
Angmagssalik	65° 37′	37° 16′	−10.8°	6.2°	− 2.2°	25.3°	−30.7°	907	?
Danmarks	76° 46′	18° 30′	−27.4°	4.4°	−12.6°	17.1°	−40.9°	145	?

Table showing the principal elements of climate and illustrating their north-south (latitudinal) range. (For additional data see: *Meddelelser om Grønland*, vols. 60–61, Kobenhavn, 1926.)

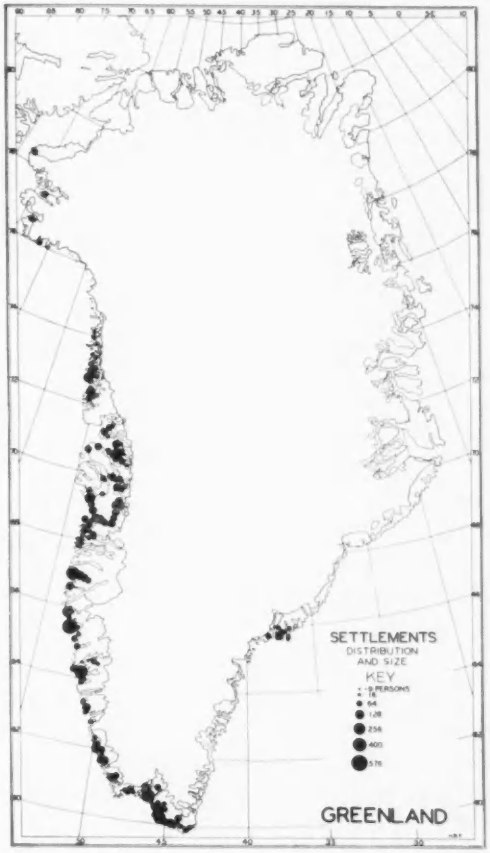

FIGURE 7.—Distribution of population by settlements. Note the distinctly west coast concentration especially from Godthaab to Julianehaab. (Statistical data as of 1925–1926. Principal source, *Meddelelser om Grønland*, Volumes 60–61, 1926.)

offered protection and ready communication with the world outside as well as permitting interfiord contact. The uplands and fiord slopes were covered with a mantle of willow, birch shrubs, and flowers, green and in blossom during the few short summer months. The river and fiord offered fish and marine mammals for food and clothing. Often a farmstead included separate areas of flat upland fields several miles from the farmhouses. Hay and forage for maintenance of livestock were the principal crops of these uplands and a sufficient amount was cut, cured, and stored for use during the long winter season. Some attempt was made to manure the tūn (homefield) and to raise garden vegetables.

The buildings and other units of the homefield reflected the limitations of the environment. The paucity of trees for timber precluded the use of wood in most units of construction. Buildings were usually low and square in form, built of stones, with a mortar of earth and grass turf, and had a sloping beam roof with one or two smoke holes. Some farms had stables, cowpens, hay yards, milk houses, and sheds, in addition to the dwellings which were usually arranged in a row.

Animal husbandry was mostly restricted to milch cows, and these were of great importance to the inhabitants. Sheep, goats, and horses were likewise of importance and nearly every farmstead had one or more of each. Animal breeding became an important adjunct of farming, though domestic animals were imported.

Summer, short as it is, was the busiest season of the year, for then the animals must be pastured and fattened which meant much herding from pasture to pasture, the long winter's supply of hay and forage crops must be gathered and hauled to the hay yard, usually by horse or boat, gardens must be tended, fish—mostly fresh water or fiord salmon—must be caught and dried, articles for trade and export taken to the trading posts, butter and cheese made and prepared for export, and numerous other duties attended to. Cultivation of grain sometimes was attempted, but usually failed. The principal foods (meats, dried fish, and milk), clothing, both woolen and fur, and articles for trade and export were the product of considerable industry, nearly all of which was expended during the summer.

Several of the more favorably located fiords became the nuclei or focal points

for fairly dense settlement. This was especially true of Godthaab and Ameralik Fiord (Leirufyoidr) of the central west coast. These became the centers of culture and trade. Population was confined to two rather extensive regions, Vestribyggd (Western Settlement) and Estribyggd (Eastern Settlement) (Figure 6). The total population has been variously estimated at from 1,500 to 3,500 during the most prosperous period of settlement (1100–1200).

a fairly regular importation of domestic animals for breeding purposes. Exports consisted mainly of train oil (seal oil), skins, tusks of whale and walrus, fish oils, wool, butter, cheese and possibly articles made by the Eskimo. In addition, exports at times also included ship ropes made of walrus hides, a homemade woolen fabric called "vadmel," and live falcons and white bears for the European courts.

The Norse period probably terminated

FIGURE 8.—The core of the settlement of Godthaab. The church and social hall are in the distance on the left. (Courtesy of Mr. Frederick Herz.)

Foreign trade and commerce, at first with Iceland, later shifted to Bergen, Norway. Trade was regular though seasonal. Several of the better located fiords, such as Igalika (Ejmarsfyorida) became the principal trading posts and termini of the Bergen trade. When the boat docked near the post the inhabitants flocked there to trade and celebrate, for it frequently happened that boats and cargo were lost enroute and then serious privation of the inhabitants resulted.

The principal items of import, as recorded in the King's Mirror and several old Sagas, were sails, rivets, knives and other ironware, and timber, in addition to malt and flour which were very important. There must also have been

in the early part of the sixteenth century, when communication between Greenland and the world outside was brought to an end.

INITIAL MODIFICATION OF THE LANDSCAPE BY THE DANES (1720–1870)

Save for the occasional whaling expedition in the neighborhood of Greenland, trade with the island after the failure of the Norse colonies was infrequent, if indeed not entirely absent, until the Bergen Company was organized and sent a ship and men there in 1720 under the command of the missionary, Hans Egede, to establish a settlement. A settlement was founded north of the

present outpost of Kangeq on the west coast. The first exports of this newly formed company were 25 barrels of blubber, 160 fox and seal skins, and a few pieces of whalebone—hardly enough to warrant the voyage.

This venture in the re-opening of relations between Greenland and the Scandinavian countries inaugurated a period of permanent settlement and consequent exploitation of the natural resources, and brought about a modification of the landscape, especially the exposed land margins of the west coast between Julianehaab and Upernivik, by Europeans. Trading posts were founded early (1743) at Godthaab, Christianshaab, Paiput, and Jacobshavn. By 1802 nearly all the trading posts and outposts extant today had been established. Julianehaab, the largest of the districts, had a population of about 2,000, Godthaab had 850, Fredericksborg had 340 and Holstensborg had 200.

The principal exports were blubber, seal oil, seal skins, cod and halibut, eiderdown, and skins of fur-bearing animals. Jacobshavn and Julianehaab were considered the most productive settlements. A score or more fishing stations dotted the west coast. Greenlanders were employed in the catch, bringing the fish to the trading stations, where the women cleaned, sized, and placed them on racks to dry and cure. The price per sledge load was usually a quarter of a pound of tobacco or its equivalent. Marine economy and land hunting were the dominant if, indeed, not the only source of revenue and items of export.

Toward the latter part of the period coal and cryolite mining served to make for a more diversified form of activity and were in part instrumental in stimulating the growth of a permanent sedentary population in several settlements, consequently in modifying the landscape of the small region of which each was a part. A dozen or more ships were used in the annual seasonal trade between the Scandinavian countries and the Greenlanders.

FIGURE 9.—Godthaab as viewed from the open sea. (Courtesy of Mr. Frederick Herz.)

The native Greenlanders became increasingly more sedentary, living much of the year in permanent settlements set up by the Danes and often in homes of European construction. Thus they became more dependent upon the Danes for their dress, household utensils and implements, and even some foods, notably coffee, tobacco, and cereals. Consequently there was effected for the time a better balance in foreign trade and an increase in the imports of linen and woolen goods, ironware, timber, and cereals. Baked bread alone was an item of import of considerable significance, one source stating that the import of this commodity in 1860 was 328,000 pounds and had increased to 550,000 pounds in 1875.

FIGURE 10.—Godthaab harbor is essentially landlocked and is about one mile east of the core of settlement. (Courtesy of Mr. Frederick Herz.)

THE CONTEMPORARY LANDSCAPE (1870 TO THE PRESENT)

The contemporary landscape is a product of serious attempts made to effect both economic and social reforms especially as they were concerned with the natives and with an end to stabilizing the production and revenue of the island. Numerous scientific investigations have been undertaken since 1870 for the purpose of ascertaining something about the island's natural resources, its structural makeup, and especially regions potentially suitable for settlement and trade. The settlements about Angmagssalik and Scoresby Sound on the east coast are a product of some of these recent surveys and attempted resettlement. The activities of the Royal Greenland Trading Company have been restricted to trading and the development of the natural resources alone, the Danish government taking over complete control of the social and political affairs of the people and doing all in its power to aid the natives in making better adjustments to modern European standards of living.

CHARACTER AND DISTRIBUTION OF POPULATION

The present population of Greenland is confined, with the exception of the small node around Angmagssalik, to the exposed land of the fiords, fiards, skerries, and strands of the west coast between Cape Farewell in the south and Holm Island in the North (Figure 7). Several small settlements, semi-permanent in nature, comprised of Polar Eskimos, are situated in the Thule district of the northwest coast. The native population consists of about 15,000 Greenlanders, who, though basically Eskimo, represent a strong admixture of European blood, namely, Danish, English, and Dutch, and the so-called Polar Eskimo of the Thule district who number about 250. In addition there are usually several hundred Danes in the service of the government or of private organizations.

Neither the present total population nor its west coast distribution are constant and historically so defined. To a large degree these are a product of attempted Danish resettlement of the now sedentary natives on better sites for trade. A census of the west coast records a total population of slightly over 5,000 in 1789; 6,046 in 1805; 9,648 in 1860; 11,190 in 1901; and 14,546 in 1923. Population has increased steadily since 1789. The small settlements circumjacent to and including Angmagssalik in 1884 had a population of 413; in

1901, 436; and in 1929 over 700. Archeological evidence seems to show that in the pre-Norse period Eskimos inhabited the southern half of the east coast, but did not inhabit the southern part of the west coast, as the Greenlanders do today.

The principal agglomerations of population are around Julianehaab, Egedesminde, Umanaq, Sukkertoppen, Godthaab and Upernivik, each an important center of trade, education, and production of articles for export (Figures 8–13).

SETTLEMENTS—SITE, MORPHOLOGY, AND FUNCTION

More than 200 small settlements dot the west coast of Greenland. Many of them are merely outposts and are only seasonally occupied. The average-sized settlement has a population of about seventy, the largest village, Julianehaab, has about 450, and more than three-fourths of the total number of settlements have seventy or less. Only a few are permanently inhabited by the Danes. The most favorable sites are along the margins and flats of fiords or on the leeward side of islands and promontories, which offer protection, drainage, opportunities for trade and most important of all, close proximity to good fishing and sealing grounds (Figures 8–13). Some settlements, especially in the north, may be found among the skerries or on the strands.

The relative significance of site, morphology, and function of the characteristic village agglomeration may be suggested best by an analysis of several selected settlements. These are: Julianehaab in the extreme south, Godthaab on the central west coast, and Upernivik in the northern portion of the west coast (Figures 14–16).

Julianehaab and Godthaab are situated in pocket-like basins of the slightly elevated seaward edge of long, slender-shaped, topographically rugged promontories, and have a south to southwest facing exposure which offers protection and a greater amount of solar warmth and direct light. Each settlement occupies a river mouth site, the morphology of the agglomeration being defined

FIGURE 11.—Holstensborg, a settlement of some two hundred persons, including two Danish officials and their families, is "situated upon a series of coastal terraces cut in the hard crystalline rock on the borders of a landlocked harbor." (Courtesy of Mr. Frederick Herz.)

in part by the axis of the river and the flatness of the river mouth area and in part by the amount of relatively flat land bordering the fiord margins adjacent to deep water. Upernivik, on the other hand, is situated on a protected southwest facing, pocket-like hollow of a small island but a short distance from the mainland.

Each settlement appears to be composed of loosely agglomerated individual dwellings or buildings taking advantage of some special element of site, such as flatness of surface, or proximity to the docks. In general, each settlement may be described as being trinuclear with respect not only to the ingredients of morphology but as well to functions. These are: (1) the administrative-trading unit, usually fronting immediately onto the fiord waters, (2) the native Greenlanders' dwelling unit somewhat more inland and often circumjacent to the former, and (3) the church, school, and social hall unit which is farthest inland from the first-named.

The trading-administrative unit is distinctly Danish in its entirety and with respect to the morphology of the buildings it is markedly European. The buildings are usually single-storied, possess a steep-sloped, heavily shingled roof, a clapboard wall, shuttered windows and a considerable attic space for storage, with entrance into the attic by ladder from the outside. The entire building is set on a stone foundation. Some of the more permanently inhabited Danish dwellings are two-storied. A distinguishing feature is the red body and white trim color of the buildings comprising the trading-administrative unit. Some of the better dwellings in the south may possess flower gardens and vegetable patches.

FIGURE 12.—A portion of Holstensborg as viewed from Carmliq Island. Note especially the absence of conspicuous vegetation, the Danish element of influence in the house types, and the nature of the site. (Courtesy of Mr. Frederick Herz.)

The native Greenlanders' dwelling unit consists of a loosely compacted agglomeration of numerous different kinds

of dwellings ranging from the distinctly native rock-walled, semi-subterranean home to the most advanced form which is conspicuously European, though simpler and in a sense more crudely wrought than that of the Danes.

The third unit (the church, school, and social hall) is obviously Danish and European in form, not only of architecture, but as well in the function for which it is intended, namely, organized coöperative enterprise.

FIGURE 13.—The settlement of Sukkertoppen presents a neat, well-kept appearance. Note especially such Danish improvements as the walk, rock wall, and bridges. (Courtesy of Mr. Frederick Herz.)

The settlements are tri-functional, serving as (1) organized protection, (2) nuclei of production, which prerequisites favorable sites in close proximity to profitable sealing and fishing grounds, and (3) centers for domestic and foreign trade. In these, site is the critical physical element.

THE DOMINANT ECONOMY

Marine economy is the dominant form of human activity on the island. From early times fishing and hunting have been the principal bases of subsistence and have evolved to a high degree of perfection. An analysis of a list of exports of native products for the fiscal year 1927–1928 describes the variety of this dominant economy:

750,000 kgs. blubber
880,000 kgs. liver
265 kgs. walrus hides
235 kgs. eiderdown
11,750 kgs. bird feathers
2,600 kgs. Baleen
165 kgs. Narwhal and walrus tusks
4,400,000 kgs. fish (various kinds)
150 bearskins
2,072 foxskins (blue)
1,672 foxskins (white)
8,000 sealskins
55 hides of white whales
15,700 shark skins
500 eider rugs

The year to year increase in export of native products is a consequence of the increasingly favorable interest and aid rendered by the Danish government, especially in (1) the expansion of fisheries, (2) establishment of fishing stations, (3) government supervision

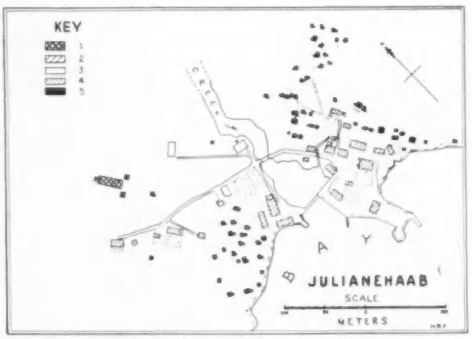

FIGURE 14.—Plan of Julianehaab colony, Julianehaab District. (Adapted from Kolonien Julianehaab, opmalt af O. Bendixen, 1919. See *Meddelelser om Grønland*, Volume 61, Atlas, Plate XIX, Kobenhaven, 1921.)

Key to numerals:
1. Administrative offices.
2. Buildings associated with trade.
3. Church, school, and social hall.
4. Storehouses.
5. Dwellings of the Greenlanders.

not only of fishing stations, but of the sale of fish, (4) the sending of government experts to organize and conduct fishing operations according to modern methods, and (5) in procuring for the native a more favorable income from the sale of fish.

Formerly the natives fished almost exclusively from kayaks, and by means of hand lines, but in recent years European boats and motor-driven boats with attending dories have rapidly increased in number and made fishing for the natives a more profitable occupation.

The principal fish caught not only for export but as well for domestic consumption, are: cod (several varieties), halibut, Norway haddock, salmon, caplin, and the Greenland shark (Figure 17). The catches are taken to the fishing stations and canneries in the Holstensborg, Sukkertoppen, Godthaab, Fredericks-haab, and Julianehaab districts, where they are prepared for export. Cleaning and preparation of the fish usually takes place on shore and is often done by the women. The Royal Greenland Trading Company is in charge of these exports and sets the standards of quality of production as well as determines the profits and losses. Fishing is most extensive on the south and west coasts.

In addition to fishing, whaling and sealing are significant items in the water economy. Whaling has been important from early times and has been carried on, especially in the sea east of Greenland, not only by Greenlanders but by several different groups of European peoples. Three species of whale, the Narwhal, the white whale, and the Greenland whale are native to the Greenland seas, and several species from the Atlantic migrate into these northern seas during the summer months. Whaling, formerly carried on very extensively, is now under government control and the number caught is limited; less than fifty were caught in 1926, whereas formerly the annual catch was in the hundreds.

Sealing is an important activity of the natives, ranking next to fishing, if not on a par with it, in the value of marine production; it is mostly confined to the ice floes and skerries of the west coast. Seal hunting is very extensive and is a year round activity. Over 12,000 are caught annually on this coast alone.

Formerly whale and shark oil was extracted and purified in the small manufactories in the settlements along the coast and exported in kegs and barrels, the staves of which had been imported from Denmark. A kind of home industry thus prevailed. Recently, however, the Royal Greenland Trading Company established an oil refinery in Copenhagen with the consequence that now most of the blubber and liver produced is salted in Greenland and shipped to the Copenhagen refinery for processing. The increasing use of blubber and liver oils in the making of margarines and vitamin extracts should serve to increase the present catch and production of these items in Greenland.

Though the dominant economy is

marine, there is a rather considerable amount of land hunting. This is most frequently seasonal and takes place during the lull in fishing activities. Hunting is usually a one-person activity; fishing a group activity. The regional distribution of the kinds of game hunted and caught is shown in Figure 17.

MINERAL RESOURCES

The mineral resources of Greenland are indeed limited, both in kind and in quantity (Figure 17). From the period of initial settlement until recent scientific investigations were made, myths have been recurrent about the vast quantities of precious stones and metals. Since about 1870 scientific investigations have proved the paucity of profitable workable minerals on the island.

Among the several minerals which are mined with varying degrees of profit, cryolite is by far the most important; it alone accounts for 99 per cent of the total value of mineral production. Formerly used in the production of soda, cryolite is now chiefly used in metallurgy and in the making of enamelware and opaque glass. The principal cryolite mines occur in the south in the vicinity of Ivigtut. First discovered in 1800, cryolite was not successfully mined and exported until 1856, when more than a thousand tons were shipped to Denmark (the total production for 1854–1864 was 12,033 tons). In 1865 an American salt manufacturing company contracted for two-thirds of all this mineral produced, the remaining one-third going to Denmark. The American company has continued to buy cryolite, but in varying quantities. In 1927 the total production was over 19,000 tons. Favorable situation in close proximity to Arsuk Fiord, which is a good harbor and ice-free much of the year, has been a prime factor in encouraging production.

Graphite ranks second in importance to cryolite in value of production. It has a wide distribution but is confined mainly to the basic pre-Cambrian rocks, and is in association with the metamorphosed coal seams. The principal areas of occurrence and production are Lang Island near Upernivik, the north side of Migssuag Peninsula and in the southern part of Egedesminde and Holsteinborg districts. Graphite has been mined since 1850. The average annual production is about 300 tons, but with a wide margin of fluctuation from year to year (e.g.: 1921, 1,500 tons; 1925, 50 tons).

Coal occurs in fairly large quantities over nearly all of the basalt area of the west coast and is in association with the Cretaceous and Tertiary deposits that are capped by basalts. The coal beds are usually horizontal, occasionally

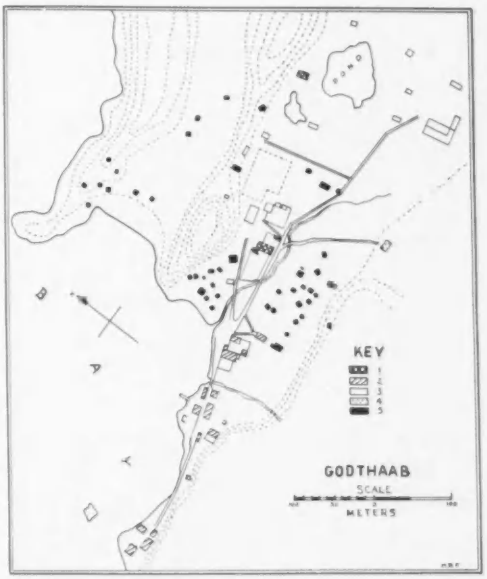

FIGURE 15.—Plan of Godthaab colony, Godthaab District. (Adapted from Kolonien Godthaab, opmalt af O. Bendixen, 1918. See *Meddelelser om Grønland*, Volume 61, Atlas, Plate XVI, Kobenhaven, 1921.)

Key to numerals:
1. Administrative offices.
2. Buildings associated with trade.
3. Church, school, and social hall.
4. Storehouses.
5. Dwellings of the Greenlanders.

faulted and penetrated by dikes, and often outcrop on the surface near the edge of a fiord. The beds vary from one to nine feet in thickness. The coal is generally of poor lignitic variety, cannot compete in export, and is used almost wholly by the natives and Europeans on the island and infrequently as bunker coal. Production began in 1780; in 1870 the annual output was 40–50 tons, whereas in recent years annual production has been about 2,000 tons.

Copper is being mined in several places though production is limited and mining cannot be said to be profitable.

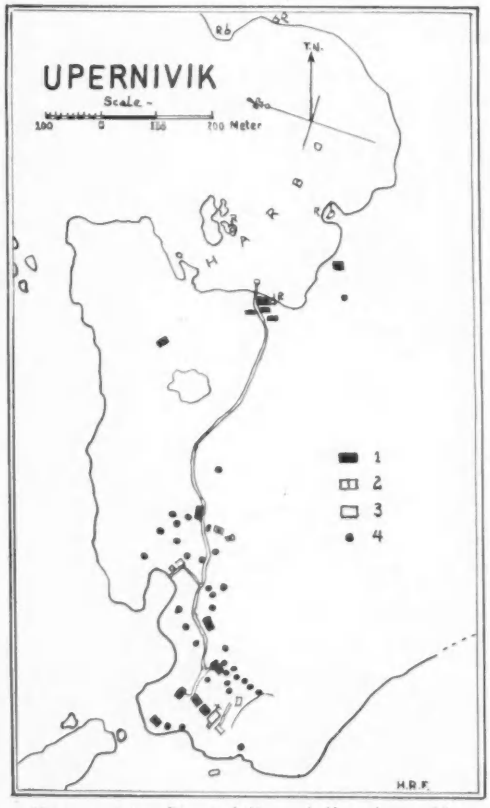

FIGURE 16.—Plan of Upernivik colony, Upernivik District. (Adapted from Kolonien Upernivik, opmalt af H. Bryder og F. Freuchen, 1919. See *Meddelelser om Grønland*, Volume 60, p. 472, Kobenhaven, 1921.)

Key to numerals:
1. Buildings associated with trade and administration.
2. Storehouses, etc.
3. Church, school, and social hall.
4. Dwellings of the Greenlanders.

The principal mines are in the neighborhood of Ivigtut. Small quantities of gold and silver are found in association with the copper.

Among other minerals mined and used locally, talc and asbestos are most important. Talc, occurring as crytocrystalline or grained steatite, has been used extensively by the native Greenlanders in the making of utensils and ornaments. Asbestos has been used for lamp wicks.

The principal mining center of the island is Ivigtut.

AGRICULTURE AND ANIMAL HUSBANDRY

Any attempts to cultivate the land must of necessity be restricted both in area and in location. From the beginning when the Norsemen first settled in Westribyggd and Estribyggd, agriculture and animal husbandry have been attempted with varying degrees of success. Few native Greenlanders have successfully taken up agricultural activities and then only under the careful guidance of a Danish official.

For several decades the Danes have tried to promote agriculture and animal husbandry. They have been rewarded with a small amount of success, especially in the Julianehaab district of the south. Here the relatively warm climate, in addition to the frequent foehn winds, makes it possible to anticipate at least partial success in agriculture and animal husbandry. A government experiment station in Julianehaab district and government subsidies have encouraged these economies.

In 1929, 700 goats, 2,500 to 3,000 sheep (mostly Icelandic), and some 70 head of horned cattle were raised and pastured in Greenland. During the winter months livestock are usually kept in sheds. Winter feed consists almost entirely of cured native grasses and

willow, and in some instances turnips and dried fish, especially caplin.

Cultivation of the soil is restricted to garden culture. Root crops, especially turnips, radishes, cabbages, lettuce, spinach, and potatoes are successfully grown. More sensitive vegetables and flowers are grown under glass in several of the stations in the south. Attempts have been made to grow hardy grains, especially barley, which, though they have never ripened, make good fodder.

TRADE AND COMMUNICATIONS

During the early period of Danish occupation trade with the natives was carried on as a form of barter, the natives exchanging their products for various kinds of European articles, especially firearms and cloth. This form of trade prevailed into the nineteenth century, when it was replaced by an exchange of commodities on a cash or credit basis all under a strict Danish State monopoly, which had the power to fix prices of all articles of trade, both exported and imported. These conditions, with but a few modifications are representative of the Danish State monopoly even today.

Greenland is divided into fourteen administrative and trading districts (Figure 1), twelve on the west coast extending from Julianehaab to Upernivik, and two on the east coast, one each at Angmagssalik and Scoresby Sound. The Thule District has been a private enterprise. Each district has one principal trading post and in addition one or more trading outposts. Julianehaab, Umanaq and Upernivik districts each having as many as eight trading outposts. These outposts frequently are from fifteen to thirty miles from the trading post and serve as distributing as well as concentration centers for commodities of exchange. Most of the outposts have a population of a hundred or more and are permanent establishments, though some are only seasonally occupied, as during the fishing season.

The trading posts are usually the nuclei of the largest settlements within the district, are in close proximity to the sea, occupy well-protected level sites, and are closely related to, if not a part of, the administrative office. The administrative-trade unit often consists of several medium-sized frame houses with outbuildings for storage. The post proper is much like that of a European country store offering for sale or exchange every commodity in demand, including foods (cereals, bread, tea, and coffee) tobacco, woolen goods, dry-

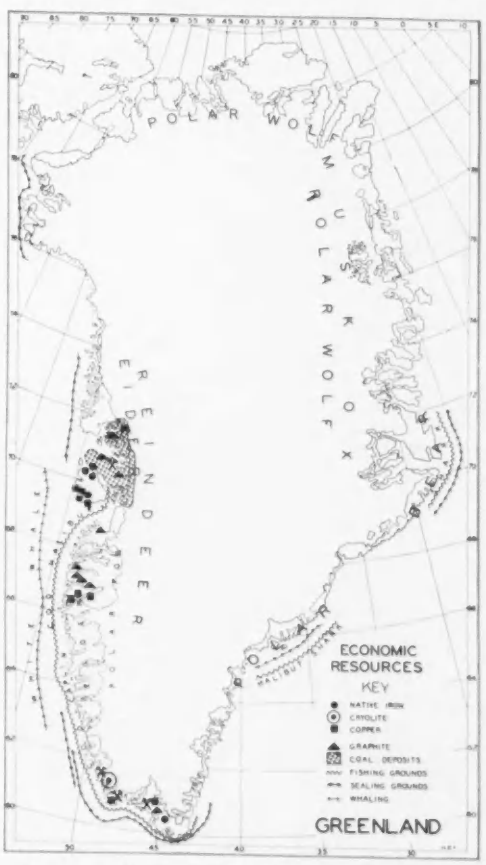

FIGURE 17.—Distribution of the principal natural resources of Greenland, especially as they pertain to and define kinds of human activity. (Principal source, *Meddelelser om Grønland*, Volumes 60–61, 1926.)

goods, hardware, firearms, building materials, and fuels. Of these commodities coffee, sugar, and tobacco bulk large, together comprising more than 70 per cent of the household purchases.

Exports and imports are carried solely in ships of the Royal Greenland Trading Company, whose home offices are in Copenhagen. Copenhagen thus becomes the mart in which articles for sale in Greenland are made and the products of Greenland are sold. Most of the products exported from Greenland come to the company factory in Copenhagen in the raw form to be refined, thus blubber and liver are refined and prepared for sale as oil or fat, skins are sorted, prepared and sold at the public auctions, fish are cured, smoked, and in other ways prepared for sale, and other articles processed or graded for sale.

The average annual value of imports and exports passing through the trading posts is about 1,300,000 kroner ($350,000 approximately), Julianehaab representing the port with the greatest volume of business. The value of articles imported annually is about 500,000 kroner and exports about 800,000 kroner. However, this alone gives an erroneous picture, for the cost of administration, upkeep of buildings, and numerous other apparently incidental items, often total sufficiently to overbalance the profits, and the annual budget may show a deficit.

Travel and communication are almost universally by water, in kayaks, umiak, or motor driven boat, though during winter months dog sledges are used extensively. Recently, wireless and radio have been introduced and southern Greenland has been proposed as a landing place for trans-Atlantic planes.

THREE MAJOR PHYSICAL DIVISIONS OF THE UPPER TENNESSEE BASIN

G. Donald Hudson

FOR many years the Upper Tennessee Basin has been recognized as a distinct unit of the Tennessee River Valley both by laymen and by scientists. Studies dealing with parts of the area or with problems in the area have been published by federal, state, and other organizations. These studies are providing materials and ideas not previously available. In view of this fact and of the further fact that brief, comprehensive statements about the physical divisions of the Upper Basin are not readily at hand, this paper, dealing with these divisions, has been prepared. It is hoped that it may prove helpful in gaining an understanding of the Upper Basin as a whole or as a framework for tying together the detailed investigations.

In making the study on which this paper is based, the first step was to break down the area into its major component divisions. This was accomplished by analyzing data from the U. S. Census (1930), by studying and analyzing soil maps, soil bulletins, and geological maps and folios, and by examining aerial mosaics. Subsequently, each division was studied with respect to its component parts, and for two of the divisions sections were delimited.

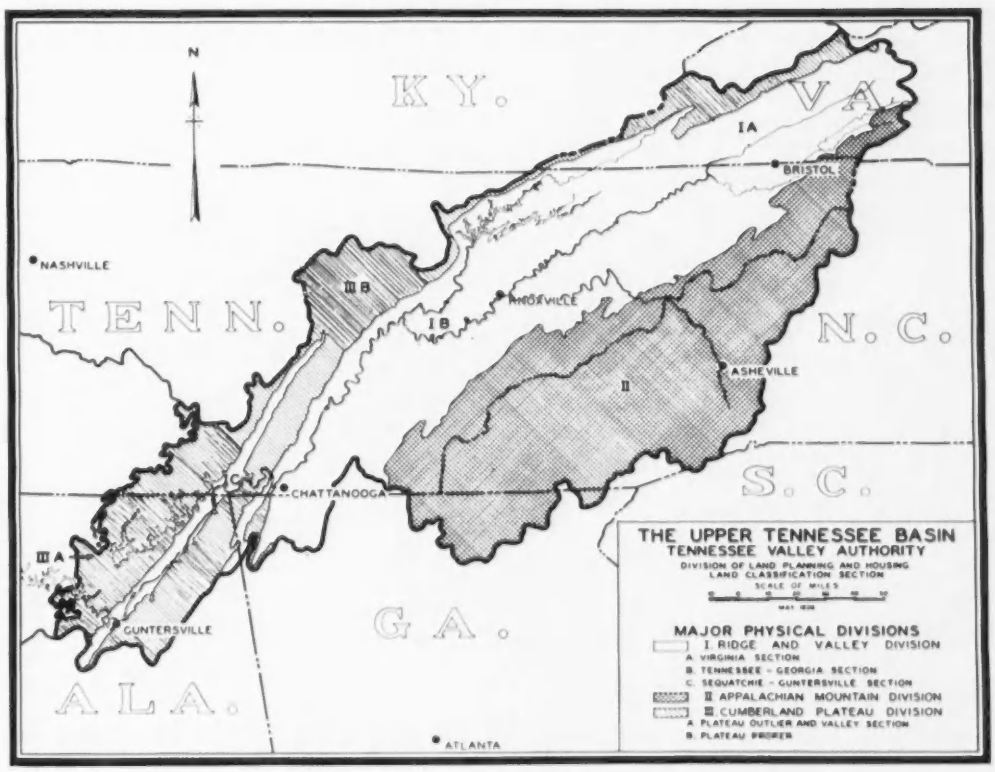

FIGURE 1.—The three major physical divisions of the Upper Tennessee Basin.

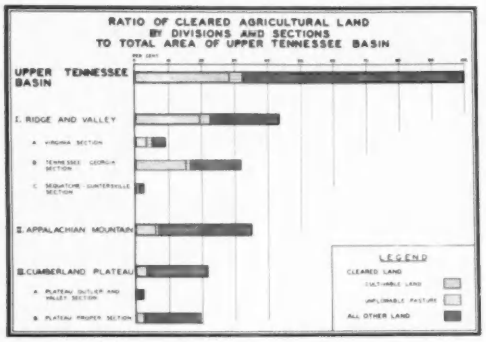

FIGURE 2.—Ratio of cleared agricultural land by divisions and sections to total area of Upper Tennessee Basin.

THE UPPER TENNESSEE BASIN

The Upper Tennessee Basin includes that part of the Tennessee Valley within which the drainage pattern has a generally northeast-southwest direction (Figure 1). It includes the highlands of the Tennessee Valley and embraces parts of three major physical divisions: the Ridge and Valley Division, the Appalachian Mountain Division, and the Cumberland Plateau Division. Those portions of the Appalachian Mountains and the Cumberland Plateau included within the Upper Tennessee Basin are largely tributary in a commercial sense to the centrally located Ridge and Valley Division. These hydrographic, physiographic, and commercial characteristics of the Upper Basin give it unity and set it apart from the remainder of the Tennessee Valley.

DIVISIONS OF THE UPPER BASIN

The Ridge and Valley Division. The centrally located Ridge and Valley Division is larger than either of the other divisions, occupying 7,052,800 acres or 43 per cent of the total land area of the Upper Tennessee Basin (Figure 2 and Table 1). A "wash-board" type of

FIGURE 3.—Ridge and Valley country in Grainger County, Tennessee, roughly thirty miles northeast of Knoxville. Sharp variations in slope, bed rock, soil, and drainage which are present in almost every locality lay the basis for marked variation in the agricultural utility of the land. In many localities the minor ridges and valleys are so closely spaced that nearly every view includes cultivated valley floor, pastured slopes, and forested ridge land. (Courtesy of E. N. Torbert.)

topography is typical of the whole division. Ridges and valleys trend from northeast to southwest in conformity with the major axis of the drainage pattern. In general, the ridges consist of remnants of the more resistant rock formations, whereas the valleys occupy the areas of less resistance. Sharp variations in slope, bed rock, soil, and drainage, therefore, are present in almost every locality. These variations lay the basis for marked variations in the agricultural utility of the land. In many localities, in fact, the minor ridges and valleys are so closely spaced that nearly every view includes cultivated valley floor, pastured slopes, and forested ridge land (Figure 3).

FIGURE 4.—A scene in Washington County, Virginia, part of the Virginia section of the Ridge and Valley Division. This section ranks third among the Ridge and Valley sections in percentage of total area in crop land and cultivable land, but first and second, respectively, in percentage of total area in unplowable and plowable pasture. Grazing is a prominent type of farming; sheep and cattle are common features in the landscape. (Courtesy of E. N. Torbert.)

Differences in physical features and farm economy from northeast to southwest set off three sections of the Ridge and Valley Division. The Virginia section of relatively high ridges and narrow valleys is distinct in character and use as compared with the Tennessee-Georgia section where relatively low ridges and wide valleys are more numerous (Figures 3 and 4). The Sequatchie-Guntersville section is unique in that it consists of a single major valley developed within the Cumberland Plateau.

The three sections in the order named occupy 1,472,000 acres (21 per cent of the division), 5,179,520 acres (73 per cent of the division), and 401,280 acres (6 per cent of the division).

The Appalachian Mountain Division. The Appalachian Mountain Division embraces 5,656,320 acres, roughly a third of the Upper Basin. The area is characterized by a terrain that is uni-

TABLE I

A COMPARISON OF THE THREE MAJOR PHYSICAL DIVISIONS OF THE UPPER TENNESSEE BASIN

	Ridge and Valley Division	*Virginia Section*	*Tennessee-Georgia Section*	*Sequatchie-Guntersville Section*	*Appalachian Mountain Division*	*Cumberland Plateau Division*	*Plateau Outlier and Valley Section*	*Plateau Proper Section*	*Upper Tennessee Basin*
AREA (in acres)	7,052,800	1,472,000	5,179,520	401,280	5,656,320	3,518,720	359,680	3,159,040	16,227,840
Per cent of total area of Upper Tennessee Basin	43.46	....	....	....	34.86	21.68	....	....	100.00
Per cent of Division	100.00	20.87	73.44	5.69	100.00	100.00	10.22	89.78	....
Population *	969,824*	....	....	....	392,685*	218,019*	....	....	1,580,528*
Population density per square mile *	87.53	....	....	....	44.43	39.65	....	....	62.19
Per cent of total population of Upper Tennessee Basin	61.4	....	....	....	24.8	13.8	....	....	100.00
CROP LAND (HARVESTED AND FAILURE) (in acres)	1,810,332	260,544	1,438,353	111,435	541,971	478,975	102,545	376,430	2,831,278
Per cent of total crop land in Upper Tennessee Basin	63.9	....	....	....	19.2	16.9	....	....	100.00
Per cent of total crop land in Division	100.00	14.59	79.45	6.16	100.00	100.00	21.4	78.6	....
Per cent of area in crop land	25.8	17.7	27.7	27.8	9.5	13.6	28.4	11.9	....
PLOWABLE PASTURE (in acres)	1,345,656	277,914	1,022,437	45,305	403,374	23,818	9,855	13,963	1,772,848
Per cent of total plowable pasture in Upper Tennessee Basin	75.9	....	....	....	22.8	1.3	....	....	100.00
Per cent of total plowable pasture in Division	100.00	20.7	76.0	3.3	100.00	100.00	41.4	58.6	....
Per cent of area in plowable pasture	19.05	18.9	19.8	11.3	7.13	0.7	2.75	0.4	....
UNPLOWABLE PASTURE (in acres)	523,149	283,360	220,648	19,141	139,083	12,461	4,244	8,217	674,693
Per cent of total unplowable pasture in Upper Tennessee Basin	77.5	....	....	....	20.7	1.8	....	....	100.00
Per cent of total unplowable pasture in Division	....	54.2	42.2	3.6	....	....	34.1	65.9	....
Per cent of area in unplowable pasture	7.45	19.4	4.2	4.7	2.4	0.3	1.1	0.3	....
CULTIVABLE LAND (in acres)	3,155,988	538,458	2,460,790	156,740	945,345	502,793	112,400	390,393	4,604,126
Per cent of total cultivable land in Upper Tennessee Basin	68.5	....	....	....	20.6	10.0	....	....	100.00
Per cent of cultivable land in Division	....	17.0	78.0	5.0	....	....	22.4	77.6	....
Per cent of area in cultivable land	44.6	36.6	47.5	39.1	16.7	14.3	31.1	12.3	....
CROP LAND, PLOWABLE AND UNPLOWABLE PASTURE (in acres)	3,679,137	821,818	2,661,438	175,881	1,084,428	515,254	116,664	398,610	5,279,819
Per cent of total crop land and pasture in Upper Tennessee Basin	69.7	....	....	....	20.5	9.8	....	....	100.00
Per cent of total crop land and pasture in Division	....	22.3	72.9	4.8	....	....	22.6	77.4	....
Per cent of area in crop land and pasture	52.0	56.0	51.7	44.1	19.1	14.6	32.2	12.6	....

* Figures for population include both rural and urban population.

The approximate population of each major physical division was obtained from the Census of 1930. In instances where a boundary line between one major physical division and another divides a minor civil division, the percentage of the total population lying within each of the major physical divisions was obtained on the basis of a population map (Distribution of Population, Population Series, Tennessee Valley Region, Land Planning & Housing Division, 1936). In all cases total population data were used, no attempt being made to distinguish between rural and urban figures.

formly rugged except for several intermontane basins (Figure 5). The larger and better known of these, the Asheville Basin, is named after the city that dominates it (Figures 6 and 7). The division is bounded on the southeast by the Blue Ridge, a long, even-crested ridge which constitutes the divide between the tributaries of the Tennessee and the streams that drain into the Atlantic. The Unaka Mountains, an equally remarkable chain, lie along the northwest boundary of the division. In general, the streams of the area rise in the southeast on the western slopes of the Blue Ridge and flow westward through the intermontane basins in relatively shallow valleys. Where they escape through narrow, canyonlike gorges into the Ridge and Valley Division, they break the Unakas into a series of segments, the most notable of which is the Great Smoky Mountains.

The Cumberland Plateau Division. The Cumberland Plateau Division, the smallest of the three divisions, occupies 3,418,720 acres, or 22 per cent of the Upper Tennessee Basin. The plateau is a well-marked physical unit, with abrupt, steep borders and a fairly level upland surface (Figure 8). That part of it which lies in the Tennessee Basin divides into two sections, the Plateau Proper and the Plateau Outlier and Valley Section. The Plateau Proper is the larger, covering 3,159,040 acres or 90 per cent of the area. Although in many places this section is cut by deep, narrow valleys, it contains large upland areas where the surface is level enough for farming. The prevalence of light sandy loams with relatively low productive capacities, however, handicaps the use of the land for some crops. The Plateau Outlier and Valley Section covers only 359,680 acres. A study of the

FIGURE 5.—This view of the Great Smoky Mountains, looking to the southeast from Newfound Gap, is illustrative of the ruggedness of the Appalachian Mountain Division—a ruggedness that is broken only by a few widely-spaced intermontane basins and isolated coves. (Courtesy of E. N. Torbert.)

aerial mosaics reveals with striking clarity that the section is composed of interstream remnants of the Cumberland Plateau which are characterized by flat tops and steep slopes, and relatively wide, flat-floored valleys.

POPULATION DISTRIBUTION

A preliminary study of the population distribution in the Upper Tennessee Basin indicates that the Ridge and Valley Division has the largest proportion of the population—61 per cent. The Appalachian Mountain Division ranks second with 25 per cent; and the Cumberland Plateau Division ranks third with only 14 per cent. Comparing the three divisions on the basis of population density, the Ridge and Valley Division again ranks first with a density of 88 persons per square mile. This figure is above the average of the Upper Basin, which is 62 per square mile. The Appalachian Mountain Division ranks second in population density, and the Cumberland Plateau Division ranks third. Both are considerably below the average for the Upper Basin—44 and 40 persons per square mile, respectively.

CULTIVABLE LAND

The relative amount of cultivable land in each major physical division and in each section is one index of relative importance from the standpoint of agriculture. Cultivable land is defined here to include all land actually cropped and in plowable pastures as given in the 1935 Census of Agriculture. These two types of land use may be said to constitute the heart of the agricultural economy of the area.

The Ridge and Valley Division. The

FIGURE 6.—Asheville Basin, the largest and best known of the intermontane basins, named after the city that dominates it. The relatively dense population and relative prominence of cultivable land in this and similar basins make the Appalachian Mountain Division rank second among the three divisions in population density and ratio of cultivable land to total area. (Courtesy of E. N. Torbert.)

FIGURE 7.—Cade's Cove, one of the relatively isolated agricultural areas in the Appalachian Mountain Division. This cove, famous for its secluded setting and scenic beauty, falls within the purchase area of the Smoky Mountain National Park. (Courtesy of E. N. Torbert.)

Ridge and Valley Division accounts for approximately two-thirds (69 per cent) of the cultivable land in the Upper Tennessee Basin. Within the division, however, less than half of the total land area is cultivable. This proportion (45 per cent) is much greater than that of the other two divisions.

Ranking each of the three sections of the Ridge and Valley Division according to the ratio of cultivable land to its total area, the Tennessee-Georgia Section stands out as the most significant with 48 per cent of its area cultivable. The agricultural importance of the section is further indicated by the fact that this cultivable area represents 78 per cent of the cultivable land in the division. The Virginia section ranks third, having 37 per cent of its total area cultivable. From the standpoint of total area of cultivable land, it is obviously of less agricultural importance than the Tennessee-Georgia section, since it includes only 17 per cent of the cultivable land in the division. The Sequatchie-Guntersville section ranks second in the ratio of cultivable land to its total area. Thirty-nine per cent of the area is cultivable, but this represents only 5 per cent of the division's cultivable land.

The Appalachian Mountain Division. The Appalachian Mountain Division, already ranked second in area, also ranks second in the amount of cultivable land in the Upper Tennessee Basin—21 per cent—and in the proportion of its area that is cultivable—17 per cent. These agricultural lands do not lie in large blocks, but are scattered throughout the area in intermontane basins or tucked in small, relatively isolated coves. The basins are of some agricultural importance. Most of them are relatively accessible. The coves, on the other hand, are largely isolated, and their importance

FIGURE 8.—Looking southward along the border of the Plateau and Ridge and Valley Divisions. The plateau is a well-marked physical unit, with abrupt, steep borders and fairly level upland surface. As seen from the air or on mosaics, the area shows a relatively continuous growth of timber interspersed by small clearings where cultivable land occurs. (Courtesy of E. N. Torbert.)

is only local. On the whole, the division is of minor agricultural significance.

The Cumberland Plateau Division. The Cumberland Plateau Division, the smallest of the three divisions, ranks third in the amount of cultivable land, and third in the proportion of its total area that is cultivable. As seen from the air or on mosaics, the area shows a relatively continuous growth of timber interspersed by small clearings where the cultivable land occurs. In the aggregate, this agricultural land represents only 14 per cent of the area, a tenth of the cultivable land in the Upper Tennessee Basin. Of the two sections in this division, the Plateau Outlier and Valley section occupies much the smaller area and includes only a small portion of the division's cultivable land. In contrast, the Plateau proper, which accounts for 78 per cent of the area of the division, contains 77 per cent of its cultivable land.

SUMMARY

The above analysis leads to certain fundamental conclusions, namely:

1. The Upper Tennessee Basin is made up of three highly distinctive physical or land use divisions.

2. Local diversity of land qualities within each division promotes local diversity of land use.

3. Most (69 per cent) of the cultivable land in the Upper Tennessee Basin lies in the Ridge and Valley Division—the largest of the three divisions. The more productive lands also lie in this division.

4. Within the Ridge and Valley Division, the Tennessee-Georgia section is of prime importance, outranking in cultivable land the combined cultivable land

in the Appalachian Mountain and Cumberland Plateau divisions.

5. The relatively high density of population in the Ridge and Valley Division is intimately associated with the agricultural importance of the area, which, in turn, is closely associated with a large amount of agricultural land and a central position in the Upper Tennessee Basin.

Materials for this paper were drawn from studies made by R. M. Glendinning and E. N. Torbert, Associate Geographers, and A. J. Gray and V. M. Throop, Junior Geographers, Land Classification Section, Tennessee Valley Authority.

BOOK REVIEWS

EAST, W. GORDON. *An Historical Geography of Europe.* 58 maps, xx and 480 pp. Methuen and Co., Ltd., London. 1935.

Refuting a slurring remark that historical geography is an illegitimate form of history, the author declares that it makes no pretense to parade as history, but is nevertheless a frontier study in which "the researches of historians, archaeologists, and geographers are brought into close relationship" and its "function and *raison d'être* . . . are the discovery of correlations between human societies and their geographical settings." He admits that for the historical geographer, Europe is "a forest of tangled undergrowth in which the explorer only with difficulty makes his way." For this book he claims only that it is introductory and that, since the subject is in its infancy, it has been necessary here "to substitute for the pursuit of wide generalization the careful study of particular illustrative cases."

If this last point is kept constantly in mind, the book is a valuable contribution not merely for the mass of facts presented but especially for its shortcomings many of which reveal what must yet be done before those "period pictures" of the past, to use the author's phrase in another work, can be successfully drawn and before his conclusion can finally be proved that geographical conditions "in contrast to the political and economic trends of the moment, possess a certain stability and rigidity, comparable almost with those of the rock structure itself." Certainly one closes this book without a very clear notion of European geography in the past or even those stable conditions which the author claims exist.

The fundamental difficulty, aside from lack of material, is that the author's method is too much that of analysis without a sufficient attempt at synthesis. Thus he has written a collection of essays of very unequal merit in which the whole is lost in the parts. In general, the most satisfactory section of the book is the first on "the geography of settlement in Europe" in which the Roman Empire is well surveyed and emphasis is laid upon the Middle Ages as a great colonizing period in which the economic center of Europe was shifted from the Mediterranean to the north. Even here, however, such great general movements as the Germanic and Asiatic migrations and the expansion of Christendom at the expense of Islam are lost to view in the detailed examination of some of their phases.

The second part of the book on political geography is disappointing since it is little more than a collection of articles which monotonously list under the political subdivisions of Europe the principle physical features of each, its agricultural and industrial products, articles and routes of trade, and a few historical events. The history presented is elementary. The other data are useful since somewhat more fully given than is customary in readily available economic histories. One wonders, however, if an encyclopedia or *Konversationslexikon* is not a more fitting place for such material until its correlation and general significance can be set forth more clearly. The same may be said of the third part on economic geography which opens with a chapter on the Mediterranean region in the middle ages and ends with a survey of Europe about the year 1870. Two exceptions should be noted, however, to the criticisms of these parts: The chapters on Sicily and on "The Danube Route-way" are fairly good demonstrations of what may be done in correlating geography and history.

The author is to be highly commended for the carefulness with which he has collected and presented his impressive mass of information. There are only a few errors of fact or print. His maps, especially those of detail, are good, though here as in the text one misses the connection between the sections and the whole. Finally, the author must be congratulated for sticking as closely as he does to his resolution not to generalize on the basis of insufficient data, a worthy example for both historians and geographers.

DWIGHT E. LEE

JONES, CHESTER LLOYD. *Costa Rica and Civilization in the Caribbean.* ix, 172 pp. University of Wisconsin Studies in Social Science and History, No. 23. Madison. 1935.

In this volume the author, for many years a student of political science, economic development, and social conditions of Caribbean countries, has presented materials that will be of considerable interest to persons interested in that area. In the study, Costa Rica has not been treated as a type. It is one of the countries which has the most striking contrasts with other areas in the Caribbean. What Costa Rica has accomplished in the development of political institutions, economic activities and social conditions is not a measure of the accomplishments in other areas of the Caribbean. The author portrays especially well the slow, painful progress of Costa Rica in all lines during colonial times and the first three quarters of a century of independence; he analyzes the marked progress made in recent times in spite of small size, limited resources, and a small population of low buying power. Costa Rica has made creditable political

advance, especially toward real popular standards of government; has improved greatly the conditions of public health, education, agriculture, communications, foreign trade, financial strength and stability, and social institutions. Compared to other areas of the Caribbean Costa Rica must be given a very high rating in these matters. Following the specific treatment of Costa Rica the author analyzes briefly, "Imperialism in the Caribbean," and "Limitations on Caribbean Civilization."

The volume is an outgrowth of years of residence in the Caribbean and two periods of residence in Costa Rica spent in an endeavor to gather an appreciation of the accomplishments of the nation at first hand and to secure statistical and other materials not available outside the country. Of special interest to the economic geographer are the portions of the volume dealing with "Coffee Takes the Lead," "The Fruit Trade and Its Influence," "Cacao and Subsistence Crops," and "Foreign Trade." Of special interest to students of political science and civilization are the chapters dealing with "Social Advance," "Social Conditions of the Present Day," "Imperialism in the Caribbean," and "The Outlook for the Future."

The author has presented a thesis deserving careful study by anyone interested in the Caribbean.

CLARENCE F. JONES

MCBRIDE, GEORGE MCCUTCHEN. *Chile: Land and Society*. xxii, 430 pp., illustrations, maps, graphs. American Geographical Society, 1936. Price, $4.00.

In "Chile: Land and Society," Doctor McBride, for many years a student of land systems in Latin America, has made an even greater contribution than in his "Land Systems of Mexico" and "The Agrarian Indian Communities of Highland Bolivia." In this volume he has given a penetrating analysis of the whole land question and its relation to society in Chile. He introduces the volume with an interesting picture of the contrasts between a Chilean land owner and his servant. These two types represent the two sharply differentiated classes which have characterized Chilean society for centuries. Even today the gap between the upper and lower strata in Chile is especially wide. Practically all of the productive farm and pasture land of the country is still held in great estates, some of which comprise tremendous areas. The land owners form an aristocracy of wealth, education, and culture and constitute the leaders in political and social life. On the other hand, the rural population consists mainly of tenants, a hard working people, who still live chiefly in ignorance and poverty. The volume is divided into three parts—Central Chile: The Land of the Hacienda, Southern Chile: A Frontier Region, and Northern Chile: An Arid Region with Scattered Settlements.

Of special interest to the economic geographer and the student of terrane occupancy are the sections dealing with agriculture in Central Chile, the detailed descriptions and analyses of types of Chilean haciendas, the influence of the hacienda, and the trends toward subdivision of the hacienda. These sections are of special value because of personal investigations of the haciendas and the thorough research of a mature student on the other phases of the topic.

With these detailed studies and thorough research as a background Doctor McBride analyzes fully the question of agrarian reform which is, without doubt, one of the most vital issues facing the Chilean nation today; he makes definite constructive suggestions towards the solution of this major problem. The subdivision of these great estates will in many ways mean a loss to Chilean society. However, the change is inevitable. Changes in conditions in Chile and the world at large necessitate a modification of the old social order. The modification of the old social order means progress for Chile as a whole. It means a more thorough utilization of resources, higher standards of living for most of the people, and a unification of the various elements of the population. This impartial, scholarly work merits careful attention by every serious student of land systems and social movements not only in Latin America but in the world at large.

CLARENCE F. JONES

JONES, CHESTER LLOYD. *The Caribbean Since 1900*. xi and 511 pp. Prentice Hall. 1936.

"The Caribbean Since 1900," in the words of the author, "represents a sincere attempt to give an objective estimate of the major developments" in the Caribbean region since the beginning of the twentieth century. It is the belief of the reviewer that the author has achieved success in this attempt.

As might be expected the greatest stress is laid upon the political developments, for Doctor Jones is interested primarily in the field of political science being professor of commerce and political science at the University of Wisconsin. For that reason the study is of greatest interest to students in the field of international relations. Nevertheless, the author recognizes the influence of geographical factors on political activities in the American Mediterranean, and students of Caribbean geography will find many sections of pure geographical writing. For example, in showing contrasts between eastern and western Nicaragua, Doctor Jones quotes rainfall figures for typical cities of each coast to emphasize these contrasts; and charts showing changes in population and

in the production of major commodities appear throughout the book.

In the opening chapter the reader discovers what may be called one of the dominant themes of the book. This theme, the increasing significance of the Caribbean to the United States and the interdependence between that country and the tropical lands to the south, may be noted throughout, but with the greatest ease in the last chapter "Independence or Interdependence." Between the introductory and closing chapters the subjects of Cuba, The Dominican Republic During and After the Customs Treaties, Haiti Under American Control, Venezuela, Colombia and the Panama Canal Controversy, and Nicaragua receive two chapters each, while the political divisions of Costa Rica, Honduras, Salvador, Guatemala, The United States Caribbean possessions, and European Colonies each receive one chapter.

The book is written in a scholarly manner, is carefully documented and includes a brief but well selected bibliography on the Caribbean Region. In writing this study Doctor Jones has added one more success to his growing list of distinct contributions to the literature of the Caribbean.

EARL B. SHAW

WAGNER, ANTON. *Los Angeles.* Schriften des Geographischen Institute der Universität Kiel. 1936.

A number of publications have appeared under the editorship of Professor Schmieder, who is becoming the authority on the Americas, in Germany. One of these publications, *Los Angeles*, by Anton Wagner, deserves the attention of American geographers. Based on a six months' stay in Los Angeles, the study shows all the earmarks of a thorough knowledge, although it is necessarily more of an introduction to, rather than an exhaustive study of, the subject, since Los Angeles cannot be treated geographically in detail in 250 pages. Nevertheless Doctor Wagner has done an excellent piece of work. The book is well written; the material is interesting and many maps illustrate the text. As could be expected from a geographer of the German school a very worthwhile bibliography containing the names of over 800 books and articles is included.

The book is divided into five sections: first, the Physical Background; second, the shift in land economy of the region; third, the beginning of settlement; fourth, the growth into a "Grossstadt"; and finally, a geographical evaluation of the present city. It is pleasant to note that the physiography of the region is well treated, showing that the German school at present puts a great deal of stress on that subject. The author's map of the Köppen divisions of the climate of Los Angeles differs from that of Russell (in the Publications of the University of California in Geography, Vol. II). The problem of water supply deserves a little more detailed treatment than it gets in this book.

The author and the Institute at Kiel deserve hearty congratulations on this book, which will find its place in America among the studies in urban geography.

SAMUEL VAN VALKENBERG

MORTARA, GIORGIO. *Prospettive Economiche*, 15th Edition. Universita Bocconi Milano. 492 pp.

A new volume of the Prospettive Economiche is always of interest, especially to economic geographers. This annual publication has justly earned the reputation of being one of the best and most up to date sources of information on the major products of the world's markets. Although the publications of the League of Nations and those of the International Institute of Agriculture of Rome are the best sources of world statistics, Prospettive Economiche excels in that it presents an evaluation of the conditions existing on the world's market.

Although, as can be expected, special reference is given to the economic condition in Italy, the other major producers and consumers are adequately treated. The section on coal is typical of the type of work presented throughout the book. Thirty-eight pages are devoted to the discussion of coal which includes production, consumption, trade, a study of the nine major producers, and a statement of the prospects for the coming year.

The products treated in this volume are coal, oil, hydroelectric power, iron, copper, cotton, hemp, flax, artificial silk, wool, silk, grains, wine, and olive oil.

The book is indispensable to economic geographers who desire to be familiar with the latest developments of the world's market.

SAMUEL VAN VALKENBERG

VON BERNEGG, ANDREAS SPRECHER. *Tropische und subtropische Wirtschaft pflanzen, Part III, Vol. 3. Der Tee strauch und der Tee, Die Mate oder Paraguaytee pflanzen.* Ferdinand Enke in Stuttgart. 1936.

This series of studies on plant crops of the tropics and subtropics by Dr. Sprecher von Bernegg, the Swiss agricultural expert, deserves the attention of American economic geographers. Five volumes have been published in this series, namely: Starch and Sugar crops, Oil crops, Cacao and Kola, Coffee and Guaraná; and the object of this review, Tea and Mate.

The treatment of the various crops is very complete. The chapter on tea contains the history of tea development; a description of the plant; a discussion of the general conditions for growth, cultivation, harvest, and the preparation of tea; its chemical composition; its use; its world production, consumption, and trade. About 300 pages are devoted to tea, and a bibliography containing the names of 350 books and articles is appended.

The geographer is disappointed to find that the treatment of world production is extremely short and that maps of distribution are lacking. Japan, one of the most important tea producers, is disposed of in two pages of regional description, which is entirely insufficient. Also Formosa is discussed on one page; India, Ceylon, and the Netherland East Indies are almost equally neglected. The author is clearly more interested in the botanical than in the geographical side of the topic. It is unfortunate that the figures of the general statistics do not go beyond 1932, and the present competition, a result of the world depression, is accordingly not taken into consideration.

Nevertheless, the book is full of very valuable material otherwise difficult to obtain and should be available in the libraries of universities where economic geography is taught. The completed series will undoubtedly contain the best botanical and technical treatment of tropical and subtropical plants ever published and will be of direct help in the teaching of economic geography.

SAMUEL VAN VALKENBERG

STAMP, L. DUDLEY. *Asia, An Economic and Regional Geography.* (Entirely revised and greatly enlarged edition.) Dutton, New York.

The well known book on Asia by Doctor Stamp has recently appeared in a new edition which differs so much from the first volume that attention should be called to it.

Most of the additions to the material concern the Far East, China and the Japanese Empire. Manchuria which was included under China in the first edition is here the subject of an individual chapter. In his introduction, Doctor Stamp acknowledges the great value of the work of American Geographers on the Far East: G. B. Cressy and G. T. Trewartha on Manchuria; G. T. Trewartha, R. B. Hall, J. E. Orchard, W. D. Jones, and D. H. Davis on Japan; J. W. Baylor, J. W. Coulter and R. B. Hall on Chosen. These authors are responsible for most of the material added to the book concerning the Far East.

Thus the value of the book has been greatly increased and the balance between the material set forth on various sections of the great continent has been equalized. We may hope that in the next edition Asiatic Russia, and especially Turkestan, will receive more adequate treatment and that an important island, Sumatra, will be given more than half a page.

On the whole the book stands out as a standard work on the Asiatic continent and will find manifold uses in American teaching.

SAMUEL VAN VALKENBERG

INTERNATIONAL GEOLOGICAL CONGRESS. *Copper Resources of the World, Vol. II; XVI.* 412 pp. Washington, D. C., 1935.

This volume, of especial interest and value to the geologist, physiographer, or economic geographer, completes a world survey of copper deposits and resources conducted by the International Geological Congress. Volume I treats the copper desposits of North America including the West Indies and contains an introductory chapter by J. W. Furness dealing with the historical development of each major producing area. Volume II is a detailed and authoritative discussion of deposits in South America, Europe, Asia, Africa, and Australasia.

Each chapter, submitted by governmental agencies and men personally familiar with the several areas, deals with the geologic history of the region, its structure, and the types of ore found and their development. Most of the book is written in English but some sections are written in Spanish, German, and French. Complete bibliographical material at the end of each chapter, a wealth of orientation and geologic maps, geologic cross sections, block diagrams, and pictures add materially to the volume.

ASBJORN FAUSE

ETUDES ECONOMIQUES: *Theses presentees a la Licence en Sciences Commerciales en mai 1935.* Publication de l'Ecole des Hautes Etudes Commerciales de Montreal. 1935.

This volume, a collection of theses presented at the Ecole des Hautes Etudes Commerciales de Montreal, is of general interest to the students of commerce and economics. However, several of the theses in the collection are of interest to, and deserve the attention of, geographers. Of this type is the thesis, *Des groupements canadiens-français au Canada* by Leonidas Jounert. The author discusses the movements of French Canadians and their distribution throughout Canada, their activities and their cultural and economic contributions. Two maps illustrate the text which contains numerous charts. More maps would be a welcome addition to the study. How-

ever, both the anthropogeographer and the economic geographer will find interesting material in this thesis.

Another thesis of interest, especially to the economic geographer, is *Les facteurs du developpement economique du Japon*, by Edouard Bosse. The author takes up individually the various products which Japan exports and imports, and considers them in relation to their meaning to Japan's economic life. The thesis lacks a discussion of the physiography and climate as such although these factors are from time to time brought into the text. The economic development of Japan is also considered in light of the wars of the nation and the political situation of the empire. Economic geographers will find here a mass of facts, with little interpretation or evaluation, and will be disappointed in the total absence of maps. However the factual material is good and the bibliography is likewise of value.

Other theses included in the volume which may be of interest to economic geographers are: *La cooperation de consommations, Role economique et social des associations professionnelles, Le Marche American du Papier Journal, L'industrie du cidre de pommes et ses possibilites dans le Quebec, Possibilites de developpement de la culture en serre chaude dans la province de Quebec* and *Movements Demographiques au Canada.*

The volume concludes with a region study of the Richelieu Region, by Emile Goulet. In this paper the historical background for the region is presented together with the physical and climatic backgrounds. A discussion of the economy and land utilization of the region follows and involves a discussion of transportation and industry. While the study is brief and many phases are but hinted at, it contains interesting material. The one map which illustrates the text is entirely insufficient.

CARL L. STOTZ

MEARS, ELIOT GRINNELL. *Maritime Trade of Western United States.* xvii and 538 pp., maps and illustrations. Stanford University Press, California.

Professor Mears who has written so ably on Turkey and Greece presents another volume which will be welcomed by all economic geographers as well as by all persons interested in geography, history, or economics.

In 432 pages the author sets forth in interesting style a clear analysis of the maritime trade of the western United States. Into this texture of present conditions is woven the historical development. A chapter is devoted to geographic influences which have directly altered trade conditions. Trade in reference to the utilization of the economic resources is adequately dealt with in another chapter. In chapters which follow the author analyzes the maritime trade to countries. Numerous conferences and government activities are set down and discussed.

Throughout, the text is greatly enhanced by numerous clearly drawn maps and charts, and an admirable list of tables, for the quoting of statistics is a real asset to the book.

The author concludes his discussion with a splendid chapter entitled "Résumé" in which he sums up the trade situation, the numerous influences which have exerted their force upon it, and the functioning of various agencies concerned with the trade. In this chapter, the author again includes the historical development.

A forecast concludes the body of the text, which is followed by an appendix including such valuable information as a directory of west coast services, 1934; passenger traffic on the pacific coast, American merchant fleets, 1934; a good discussion of the sources of statistics, an admirable collection of statistical tables, and a valuable list of references.

University libraries and economic geographers cannot afford to be without this valuable source material.

CARL L. STOTZ

PEATTIE, RODERICK. *Mountain Geography; A Critique and Field Study.* xiv and 257 pp., maps, charts, photographs. Harvard University Press, 1936. Price $4.00.

In this "Mountain Geography" Roderick Peattie has produced a noteworthy work, in many ways a great book, both in subject matter and in style. It is stimulating, refreshing, exhilarating almost, as the mountains with which it deals, without in any wise waxing sentimental, or wavering from scholarly, scientific treatment. In content and style it represents restraint rather than the struggle for effect so many scientific books reveal because the nature of the material of which they are built is so prosaic. Wisely and effectively, the author has avoided the temptation to rhapsody, a temptation to which he might easily have succumbed; the very exaltation his mountains must surely have forced upon him as he wandered among them, both in the field and in his writing, might have led him into such temptation. Having seen the Matterhorn or the Jungfrau, Fujiyama or Kazbek, Kenia or Aconcagua, any one of us might be forgiven the temptation to wax enthusiastic and eloquent.

But Roderick Peattie has wisely restrained himself, and consequently his every chapter carries conviction, and evidence of high scholarship, integrity of research, and thorough craftsmanship. He has so marshaled his array of fact and supported it by such wealth of reference from the great masters of geology, geography, botany, anthropology, literature and art, that

his every point, his every principle seems difficult of doubt or refutation. It is a "critique" in the best sense of the word, but it is likewise a distinct contribution in itself, in that it not only surveys and summarizes the whole field of the subject, but presents a very considerable mass of new material he has collected and examined critically in his own field work.

Ten chapters constitute the book. Perhaps no better way to explain what "Mountain Geography" comprises can be chosen than to enumerate the titles of the chapters and briefly characterize their content. They follow:

1. Mountain temperatures,—including pressure, insolation, mountain mass, temperature inversions, altitude and growing season, air temperature ranges and extremes, and soil temperatures.

2. Humidity and precipitation,—in which fogs, hazes, rainfall, floods and torrents; snow and its effect upon human life, snowslides, and ways to avoid their destruction, all are treated fully.

3. Winds, clouds, and sun,—a fascinating chapter in which the wild free winds of the mountain peaks and valleys are brought under the scientist's regimentation for study; distinctive clouds are clearly described; and such an important phenomenon as the foehn wind is treated at length.

4. Vegetation zones and the limits of fields,—presenting the interesting relationship between direction and degree of slope, latitude, and altitude, to the snow line; the importance of sunlight, of rock and soil, of valley floor, piedmont slope, and rugged rock wall upon the type of vegetation, and the extent of pastures and fields.

5. Forests and their significance,—the tree line and forest line as affected by physical factors, plant factors, and economic factors form the major theme of this valuable chapter, and naturally introduce the next.

6. Alp pastures and alp economy,—in which the ever-interesting mountain pastures with their wealth of flowers, their clear cold streams, their sweet fresh air, are discussed at length.

7. Land utilization and economics—in fewer than fifteen pages of text supplemented by several maps and photographs, the geographically significant problems and phenomena of land utilization and economy are inadequately discussed, the one somewhat unsatisfactory chapter of the book.

8. Mountain populations and their distribution,—a chapter that summarizes very satisfactorily the salient features of mountain demography.

9. Matters political,—a charming analysis of the political character and composition of mountain states, and the political attitude of their peoples.

10. The character of mountain life,—a commentary upon the outstanding attributes of cultural responses and patterns as they are related to the accentuated distinctions of the seasons, as exemplified in the tenor of Andorran, and other mountain life.

Every chapter is richly documented with references germane to the content and point of view it presents, and the book closes with a working bibliography of the best literature on the geomorphology of mountains, contributions and reviews of contributions on the subject.

Merely to relate thus generally the content of the book is not sufficient to do it full justice. It is, in a measure, a comparative treatise of the subject, despite the topical arrangement of chapters, and gains in value and freshness by that approach. The regional aspect is indirectly and fragmentarily presented, not wholly a fault in view of the present riot of rampant regionalism.

Another good quality of the book is its frank emphasis upon the so-called "theory of environmentalism" and its frank avowal of faith in the now wellnigh discarded idea of the part that physical control plays in human culture. As the publisher's note states, "although there is no attempt to preach determinism beyond catastrophes, nevertheless there is a definite plea made to American geographers to revive their interest in the importance of environment, rather than confining themselves to man's part in reforming environment." Such a frank, challenging statement is not likely to be ignored by the regionalists, the chorographers who have so finally determined just what geography should be, and is, in their opinion; it will be interesting to see when the gage of battle is accepted, and how the issue is joined.

"Mountain Geography" is without question a stimulating book, a book much needed at this time. It has its place both as text and reference. It has its place in shaping the thought and progress of geography. It has its place in the literature of the subject with which it deals. The author deserves congratulation upon a difficult work, well done, whatever the point of view of friend or friendly opponent.

W. ELMER EKBLAW

UNITED STATES DEPARTMENT OF AGRICULTURE. *The Western Range.* 620 pp., illustrations. United States Government Printing Office, Washington, D. C., April 24, 1936.

During the past five years government agencies have been turning out an enormous amount of literature part of which is excellent material for the field of geography. Geographers and others interested in the practical problems of and the planning for natural resource restoration and conservation will welcome this additional well-done governmental publication. This volume, prepared by a large number of Forest Service employees, is a symposium covering the various phases of the Western Range. According to F. A. Silcox, Chief of the Forest Service, the book ". . . includes the pertinent information now available in the Forest Service and that which

could be obtained from Federal and State agencies." That the authors of this book have not limited their treatment of the subjects alone to information compiled by governmental agencies is clearly shown by references made in it to various publications, and also by the quotations of material taken from other sources. On pages 557 to 566 of the book is a bibliography of 189 pieces of literature cited.

The content of the book is grouped under six parts, namely: I, The Major Range Problems and Their Solution—A Résumé (70 pp.); II, The Virgin Range (10 pp.); III, The White Man's Toll (36 pp.); IV, How and Why (184 pp.); V, Its Social and Economic Function (118 pp.); and, VI, Program (138 pp.). A detailed picture of the origin of the range types of vegetation with a brief statement of what the range offered the first pioneers is taken up in Part II. Part III gives an excellent quantitative analysis of forage depletion in the principal range types. This part is amply and well illustrated with twenty figures and sixteen tables. Some of the figures are a composite of six graphs, for example, Figure 14 shows depletion in the six different ownership classes. The tables contain statistics which stress and synthesize important points; to illustrate, Table 19 shows depletion of virgin range in the open-forest type by ownership and depletion classes. Having constructed the present physical setting of the range problem with Parts II and III, the authors take up in Part IV the how and why of the situation. This part contains the following important sections: History of the Range Use, Climatic Fluctuations, Excessive Stocking, Rule-of-thumb Management, The Lag in Research and Extension, Financial Handicaps, Unsuitable Land Policy, and Range Conservation and Exception. Part V stresses the multiple social and economic functions of the western range. The four primary functions are watershed protection, home for wildlife, areas for recreation, and an integrated part of western agriculture. Part VI gives a detailed account of a constructive and feasible program.

Earle H. Clapp, Associate Chief of the Forest Service, who writes the résumé stresses the major findings in this summary. Mr. Clapp seems to be confident that he has not only discovered the "key to remedial action," namely, "the centering of governmental responsibility," but, by saying that the western range problem should be handled by the Department of Agriculture, he believes that he also knows how to unlock the door. Although Mr. Clapp may be a little biased in his conclusion as to where the responsibility should be placed, and one need not agree with him there, most readers will heartily agree with him that the responsibility should be centered some place and quickly. The deplorable condition of the western range should be an excellent argument for the reorganization of governmental agencies in Washington, D. C., this year.

Persons interested in having their school library make a valuable collection of geography literature should have their librarian order this volume. It is readable, well illustrated (89 tables and 87 figures), and filled with factual information, much of which is the fruit of recent experimentation and research made by governmental employees. It will furnish excellent supplementary reading to Chapters 6 and 7 of the book "Our Natural Resources and Their Conservation" edited recently by A. E. Parkins and J. R. Whitaker. If assigned for supplementary reading, the treatment of the range question ". . . with its multiplicity of interrelated overlapping problems which require corresponding interrelated overlapping remedial measures" should help orient the reader and illustrate a method of treating elsewhere modern complex problems.

THOMAS F. BARTON